

Threat to teaching companies

by Robin McKie
Science Correspondent

The expansion of Britain's highly successful teaching company scheme, which links manufacturing industry with universities and polytechnics, is being threatened by cash cutbacks at the Department of Industry.

An urgent strategy review has been launched in a bid to highlight alternative sources of finance for the scheme, including possible increased revenue from industry.

This move follows a recent warning by the Department of Industry, which jointly funds teaching companies with the Science Research Council, that it can only contribute about £600,000 of its half of the £1.2m needed to finance the scheme this year. The department may make up this deficit later in the year, or

the extra cash could be supplied by the SRC.

The real problem will come in future years when it is hoped to expand the scheme and increase spending to about £1.8m a year. The department has warned it cannot guarantee its full share of these costs any longer.

This could be a serious blow to a highly successful project which was set up in 1977 as direct equivalents of teaching hospitals and allows graduates to work in real life industrial situations. They are funded by the DoI and SRC and their work includes projects for improving manufacturing processes and plant performance for a particular firm.

It was originally planned that

there would be 20 teaching companies set up by 1981: there are now 33 such programmes with many industrialists and academics anxious to set up more companies. It was also hoped that the scheme would expand into areas other than manufacturing, including chemical and civil engineering.

The strategy review is urgently seeking ways of making up the likely shortfall in funds and a variety of methods are being investigated, including, as one academic contacted with scheme stated, "everything from the Common Market to a blind box outside Woolworths".

The review will also examine ways of possible cost cutting and improving the efficiency of the teaching companies' administration.

Technical study sites considered

by Charlotte Barry

The site of the new Technical Change Centre, previously known as the Centre for Analysis of Technical Change, has been narrowed to three choices. It will be based at either Oxford University, Manchester University or Imperial College, London.

However, the committee of nine academics and civil servants headed by Sir Michael Swann, professor of Civil College, Oxford, will not make a final decision until a director is appointed.

Advertisements for this important post, which could go to an academic civil servant or industrialist, will appear soon in the national press. Applications will be processed from the end of this month.

Originally a London-based team, the committee has now widened its net to include universities and polytechnics. Since then, South-eastern and Cambridge universities, a number of London colleges and Cranfield Institute of Technology have expressed interest.

Another contender is the Science Policy Research Unit at Sussex University and it is surprising that it has not made the final shortlist. This is believed to be because SPRU is to be used extensively by the new centre for outside contract work.

The final choice rests heavily on a combination of geographical convenience and the existence of a major group at the institution. The committee is also looking for a site with a strong research background in economic and technical change.

Imperial College and Manchester University, and to a lesser extent Oxford University, have extensive research in this field of study.

The independent centre, which will cost about £750,000 a year to run, will be supported by £525,000 from each of the Social Science and Science Research Councils over the first five years. This will be backed by £1.5m from the Leverhulme Trust, which will be used to build the centre up as quickly as possible.



Sir Michael Swann, go-ahead

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school to the younger school, never requiring additional training, they argue that this is the best way of providing facilities for pre-tertiary and tertiary training.

Opportunities for recurrent education and training are under-estimated, they say, and should not be seen as something that can be dispensed with but which must be used as and when they see fit.

Similarly, although university education is continuing to grow, during the last 10 years of the decade it will decline by the year 2000, presenting the choice of increasing places to meet the growing demand for university places or, as the authors say, "reducing the number of places".

Because the authors have already been in the past, they say, and it is a current policy to encourage a "broad-based" education, which will be used to the best advantage, it is not the authors' intention to suggest that the system should be changed.

We do not believe that the present system is declining, but that the projections showing a decline in the number of places are based on assumptions which are not realistic. It is our intention to suggest that the system should be changed.

Boyson comes under fire over AUT pay

University lecturers' leaders are giving the Government a further chance to say when it will respond to the 19 per cent pay deal agreed with their employers.

Despite an indication more than two weeks ago that ministers would call a meeting of Committee B, the second stage of the negotiating process when the Government responds with a counter-offer, the end of this month, there was no sign this week of a date.

Ministers are coming under increasing pressure from MPs over the continuing failure to call the meeting. Dr. Rhodes Boyson, under-secretary of state for education, said he hoped it would be convened "very shortly".

A lobby of Association of University Teachers members will next week press the case for an early decision on the deal finalised with the employers in mid-May.

The union's executive is due to meet later in the month to review the position. Last week the executive decided "against" immediate use of sanctions to force a decision.

Poly leaders plump for GLC control proposal

by David Johnson

Added support for putting the eight London polytechnics under the control of the Greater London Council (GLC) has emerged this week.

In a last minute submission to the Young committee three leading figures at North London Polytechnic suggest an alternative to GLC control would be for the five inner London polytechnics to join with North East London, Middlesex, Kingston and a number of other higher education institutions under the wing of a committee of elected or nominated GLC councillors.

The three, the governor of North London, Mr John Diamond, his vice-chancellor and the polytechnic's director, Dr David Macdonald, emphasize that they do not speak for the GLC or the GLC councillors, which is totally opposed to the break-up of ILGA.

They also resist any suggestion that their decision to make an additional decision on an indication of differences of opinion among the directors of the five ILGA polytechnics and their chairman of governors.

The Committee of Directors of London Polytechnics prefers the idea of national funding but accepts that in the current climate of firm Government opposition to this solution that ILGA should not be broken up.

The submission from the PNL would satisfy many of the demands which the GLC councillors have made. Half the students involved, London polytechnics from the GLC area and surrounding counties and the inner London polytechnics, director of Thames Valley University, said: "It is an unreasonable suggestion for the directors to make. It is not their job to try to solve the Government's problem for them."

The break-up of ILGA is roundly condemned at a 200 teaching and non-teaching staff from the inner London polytechnics last week.

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British library gets funding

Funds to build the first stage of the new British library building are available, Mr. John Stevens, chancellor of the Duchy of Lancaster, told a group of MPs this week.

Addressing the Select Committee on Education, Science and the Arts, Mr Stevens said that this stage could be paid for by the present budget of the Office of Arts and Libraries. He said that no decision had been made on whether to go ahead but an early decision could be taken.

If a decision was favourable, then the first stage could start next year. One of the advantages of the three-stage project was that it could be accelerated or decelerated.

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Drop in overseas numbers 'unlikely'

by Ngai Crenquer

Years of a massive drop in the number of overseas students coming to British universities in October are unlikely to materialize.

Many report that applications are about the same as at this time last year and some have found increased demand. Even those institutions reporting falls are not facing the acute loss of numbers anticipated as a result of the Government decision to charge overseas students full cost fees.

Nevertheless, the universities are still expressing considerable caution and admissions officers stress that they will not know the true position until the students actually arrive. There is concern that some students will come and then find they cannot afford to continue.

At Cranfield Institute of Technology, applications for the most expensive course in Britain (aeronautics students from overseas will have to pay £6,000 next year) have increased from 118 in 1979 to 140 by June 1980. Almost as many overseas students have applied as last year and standards of applications have remained high.

At Manchester University, overseas applications for undergraduate courses are up by 26 per cent. Postgraduate applications are holding up fairly well, though less well in science. The university expects to retain a similar intake to last year.

At the University of Manchester Institute of Science and Technology, overseas undergraduate applications

are down by 11 per cent. Most departments report marginal increases in postgraduate applications but the university is anxious about the position.

Universities which have created new courses are reaping the benefits. Essex, which has started two new courses, reports an increase of 32 per cent in undergraduate overseas demand and expects a slight fall in postgraduate numbers. Bath says recruitment of overseas students is "very encouraging" and does not anticipate any decline.

The London School of Economics, which will put on new diploma courses, expects about 250 more students from overseas next year, although it was hoping for an increase of 400. A number of London schools have advertised

extensively abroad, particularly in America. At the School of Oriental and African Studies, applications, offers and acceptances are broadly similar to this time last year.

At Imperial College there has been a noticeable decline in postgraduate numbers, but the standard of overseas applicants has fallen. There has also been a change in the 'countries of origin'. Fewer students are coming from the Indian sub-continent, the Far East and the poorer African countries and more from the Middle East and South America.

At Queen Mary College, firm acceptances by overseas undergraduates are down by about 15 per cent compared with this time last year, and at Liverpool overseas undergraduate applications are down by about 10 per cent.

Health blow to foreigners

by John O'Leary

Overseas students face a new blow in the next months with the prospect of exclusion from free medical treatment under the National Health Service.

Proposals under consideration at the Department of Health and Social Security would introduce charges for all foreigners, using the concept of ordinary residence as a qualification. Only those whose countries have reciprocal agreements with Britain would be exempted.

In a written reply to a Parliamentary question last week Mr Patrick Jenkin, Secretary of State for Social Services, confirmed that the Government was considering ways of reducing the cost to the NHS of providing free treatment to overseas visitors.

He told Mr Alan Beith, Liberal MP for Berwick, that those not ordinarily resident in Britain had no rights to treatment under the NHS, but such had been provided for holidaymakers, businessmen and others "as a concession".

Dr Gerard Vaughan, Minister for Health, has refused to allow fears expressed in letters from the National Union of Students and the United Kingdom Council for Overseas Student Affairs that the policy will exclude foreign students from using university health services.

The executive of the British Student Health Association is writing to Mr Jenkin and other MPs to protest at the possible changes. Previous discussions have been held with the British United Provident Association to assess the feasibility of special policies for overseas students.

It is understood that a Government statement on new health regulations is likely before Parliament's summer recess.

Students might be expected to take out medical insurance before joining courses in Britain. Mr Rupert Bristow, secretary of UKCOSA, estimated that such a stipulation would add more than £100 in an overseas students' annual costs.

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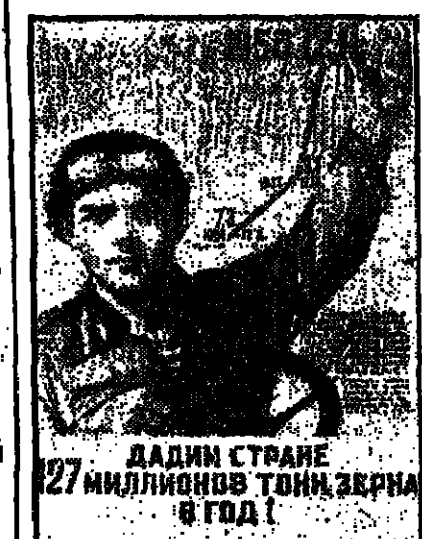
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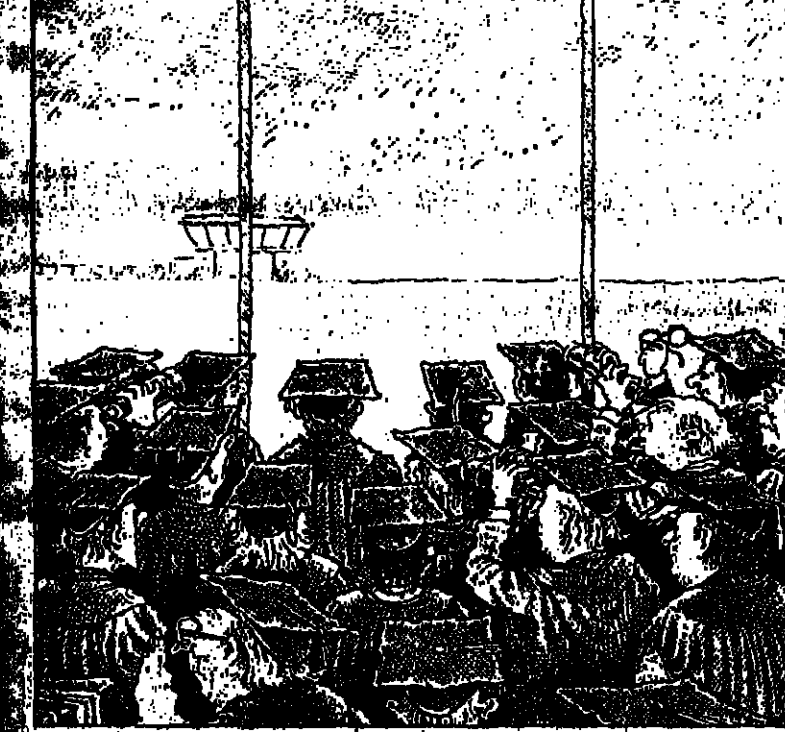
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Training grant to be axed

The Committee of Vice-Chancellors and Principals plans to cut off an annual grant of £16,000 for co-ordinating the training of lecturers from next year, although a review of the grant is being carried out.

The decision was announced last week by the CVCP, which is co-ordinating the training of university lecturers. The grant was set up in 1972.

A review group under the chairmanship of Sir Harry Pitt, former vice-chancellor of Reading University, reported in February that the grant should be increased to £40,000 and the life of the committee extended for up to six years. The NUS submission called for greater commitment to lecturers' training and greater resources for the co-ordinating committee.

Dr David Mack, a senior lecturer at Loughborough University of Technology, who is in charge of development, said the decision had gone against the grain of the CVCP's work. "Without a central body there will be no impetus to increase lecturers' training and I doubt if the present levels will be maintained."

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Breakthrough for Brunel researchers

by Robin McKie
Science Correspondent

An agreement which could lead to a breakthrough in negotiating staff appointments for researchers in non-teaching posts at British universities has been reached at Brunel University, it was revealed this week.

The deal, worked out between the university and the local branch of the Association of University Teachers, will provide appointments for researchers on fixed-term contracts with at least 10 years' continuous service who have reached the age of 55. Funding for these extra posts will be provided from earnings from outside sources, such as industrial and public body research contracts.

It is now expected that the agreement, which was finalised last week, will lead to strong pressure from the AUT for similar deals to be arranged at other universities.

Mr John Akker, deputy general secretary of the union, welcomed the move and added that "some of the principles established, like the purchase on research grants, are in principle what we shall be making to universities and other bodies".

Brunel University also maintained that the new contract would have implications for other universities. Mr David Neave, general secretary of the university, said: "We are leading the way in this and we expect other universities to follow."

The Brunel-AUT deal includes provision for one to two-year extensions to contracts of researchers with continuous service of between four to 10 years. This will allow them time to find extra funding for their work and allow Brunel to maintain a nucleus of good researchers which might otherwise disperse at the end of fixed-term contracts.

New redundancy scheme for lecturers

A national redundancy scheme designed to make it cheaper to shed academic staff in polytechnics and colleges is being examined by senior local authority officers.

The aim would be to transfer the cost of redundancy payments from individual authorities to the national Advanced Further Education (AFE) pool. At present these costs are met locally.

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£50m space project to probe comet

by Robin McKie
Science Correspondent

Europe is to send its own space probe to explore Halley's comet when it next approaches Earth in 1986. It was decided by the European Space Agency's science programme committee last week.

The £50m project, named Giotto after the Italian painter Giotto di Bondone, whose 1304 painting is considered the first naturalistic representation of the comet, will carry cameras, a mass spectrometer and other instruments to within 1,000 kilometres of the comet's nucleus at a speed of 70 kilometres a second.

The mission is ambitious but risky because the probe could be damaged by the debris surrounding the nucleus. Senior V. Manno, ESA's co-ordinator of scientific programmes, described Giotto as "a kamikaze mission", although he added that he considered it "an important first in space as an out-of-the-box properly investigated a comet before".

The controversial decision to go ahead with Giotto also means that other ESA science missions, including Hipparcos, a probe to accurately plot star positions, will be delayed to give priority funding to the comet project.

The Giotto mission replaces a previously planned joint United States-European attempt to investigate both the Halley and another comet known as Tempel 2. This project had to be abandoned when United States' President Jimmy Carter trimmed America's space budget in February as part of his attempt to balance the country's fiscal programme.

In deciding to go it alone, ESA scientists maintain the knowledge of comets is particularly important because these objects are remnants of the giant dust cloud out of which the solar system condensed, and should provide vital clues about the origin of planets.

Boyson fends off fees criticism

by John O'Leary

Ministers are considering asking the Hongkong government to transfer funds from its universities and polytechnic into loans for students having to pay full-cost fees in Britain, Dr Rhodes Boyson, Under-Secretary for Higher Education, has told MPs.

Dr Boyson was replying to criticism from both sides of the House of Commons in an unusually well-attended adjournment debate on university fees for Hongkong students. The subject was raised by Sir Paul Bryan, Conservative MP for Hove, who called for equal treatment for Britain's dependencies with the six French overseas departments whose students are considered EEC nationals.

"Colonial exploitation is a term which I hoped had passed from the terminology of the relationships between Britain and its dependent territories," said Sir Paul. "The retention of discrimination in this matter against British dependent territories is an extraordinary inconsistency which I hope will be removed before the fees become due in this autumn."

"The relationship between Britain and Hongkong was advantageous to

both and needed to be nurtured. There are, no doubt, good reasons for including in the EEC those remaining French colonies which are departments of France, but it is preposterous to allow the technicalities of the Treaty of Rome to drive us to make absurd distinctions in recognition of obligations to the dependent territories," Sir Paul said.

Dr Keith Hampson, a Parliamentary Private Secretary in the Department of the Environment, supported the call for the fee exemptions to be widened. He said he had been struck by the concern expressed over fees on a recent visit to Hongkong. It was the touchstone of the relationship.

Dr Boyson accepted that the distinction between the British and French dependencies might be morally wrong, but said it was a legal question. Only seven students had come to Britain from the French departments in 1977-78, and the EEC was the only area of the world which sent fewer students to this country than it received.

With the development of higher education in Hongkong the demand

would be for postgraduate places and the Government's fund for overseas research students would support one in seven of those categories within three years. In addition, he said, ministers were examining Hongkong's loan system, which provided £26m to the two universities and \$8.5m to the polytechnic last year.

"Perhaps the government of Hongkong could be approached on the possibility of some of that help being transferred to Hongkong students in this country," said Dr Boyson, adding that he discussed the proposition with the Foreign and Commonwealth Office.

In a debate in the House of Lords, Lord Gladwyn called for a meeting on the subject of overseas students' fees between British ministers and their Commonwealth counterparts to consider ways of tempering the worst effects of the policy. This should follow next month's Commonwealth Education Conference, in Colombo, and consider an expansion of state-aided scholarships, the introduction of special student visas and extended reciprocal arrangements between countries, he said.

Mr Noll Kinnock, opposition spokesman on education, said he welcomed any initiative to tackle the problem. But he urged the Government would come up with the finance of constructive concern needed to solve the problem.

Dr Raymond Ricketts, director of Middlesex Polytechnic and chairman of the Committee of Directors of Polytechnics, welcomed the Government's initiative but called for a more adventurous solution.

He warned that without drastic action some schools would be forced to drop key subjects. The answer lay in releasing staff from industry and further higher education to teach in schools.

Staff from the engineering, science and maths department at Middlesex Polytechnic have already written to three local boroughs, Enfield, Barnet, and Haringey, making it clear they would be prepared to spend some of their time teaching in local schools.

Dr Boyson said the Government was considering a range of options including a national scholarship scheme, guaranteed jobs, and differential salaries, as ways to overcome the shortage of school teachers in certain subjects.

Baroness Young, minister of state for education, told the annual conference of the Council of Local Education Authorities at Solihull last week that the national shortage of teachers of mathematics, physics, chemistry, and craft design and technology was one of the most worrying problems at present.

Last January local authorities had vacancies for 600 mathematics teachers, 500 physics teachers, and 400 teachers of craft design and technology, she said.

Baroness Young was also worried by the loss of large numbers of able and relatively young mathematics and science teachers to better paid jobs in industry.

Among the ideas canvassed by Baroness Young were:

- Differential salaries, with supplementary increases and enhanced

UGC policy on nurseries 'harmful'

by Ngaiio Cregar

Two weeks before the expiry of the University Grants Committee's line for universities to maintain nurseries, a report says this policy could have a devastating effect on the demand of equal opportunities higher education.

The UGC policy is one of a financial threats facing universities and college nurseries, which was singled out in a report published this week by the Equal Opportunities Commission. The report, based on a 1979 survey carried by the National Union of Students, says that the UGC policy has been a major factor in the decline of nurseries.

The two other dangers are the proposed changes in student allowances, which may be strengthened UGC power in the future, and the introduction of a new money is spent and will be used by other departments for the funds, and the public expenditure.

According to the report, the UGC policy is a financial threat to universities and colleges. It is a policy which is likely to lead to the closure of nurseries, which are a vital part of the higher education system.

The report of Professor Shooter and his committee was originally leaked to the press last year, by Clive Jenkins, general secretary of ASUE, following the death of one of its members, medical photographer Mrs Janet Parker, who contracted smallpox while working at the university. Shortly after, the head of the medical microbiology department, Professor Henry Bodson, committed suicide.

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Birmingham attacks move to release smallpox report

by Robin McKie

Science correspondent

Birmingham University this week launched an astonishing, blistering attack on the Government's decision to release the Shooter report on smallpox outbreak there two years ago.

"It is a biased report—possibly the most biased document that has ever been issued in this country at such a high level of authority," a university statement claimed.

The Department of Health and Social Security said the publication decision had been made because of associated legal difficulties had been raised. The move was welcomed by the Association of Scientific, Technical, and Managerial Staffs, whose members were affected by the outbreak.

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Birth centre could become problem child

by Olga Wojtas
Scottish Correspondent

A £1m centre for research into reproductive biology opened in Scotland this week with a warning that its work would raise a host of legal, human and ethical problems.

The warning came from Madame Simone Veil, president of the European Parliament, who was receiving an honorary degree from Edinburgh University, which is funding the centre in partnership with the Medical Research Council and the Lothian Health Board.

Speaking at the opening ceremony, Madame Veil said the world was facing a revolutionary situation in the social act from procreation. Many countries had already passed legislation governing artificial insemination, but there could be even more complex problems in the future with the birth of children conceived normally by a couple after which the sperm is implanted in another woman.

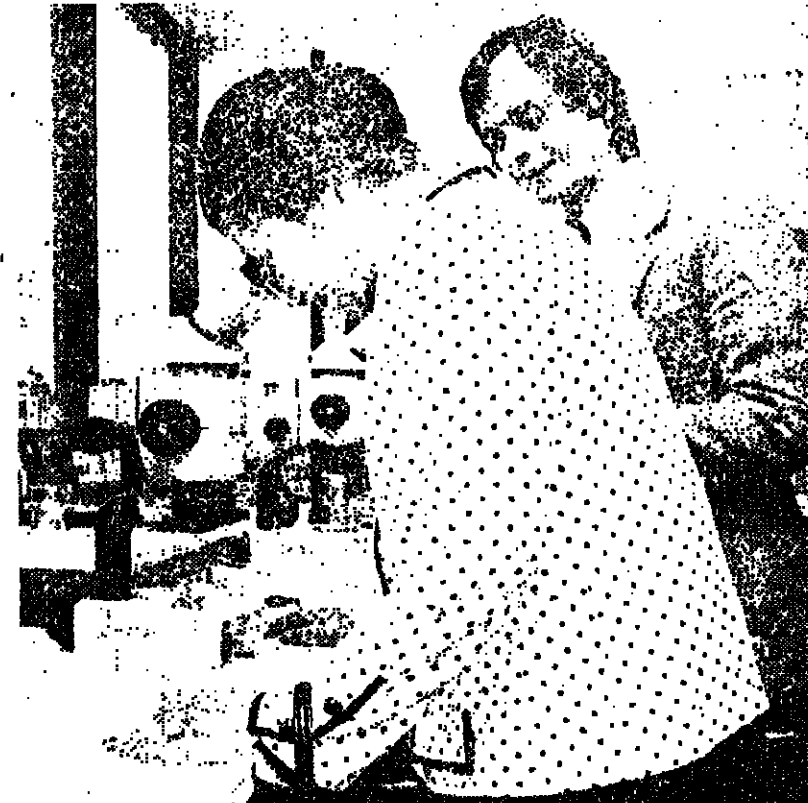
She warned that there was already a profound disparity between the considerable progress of scientific and technical knowledge, and the far more halting progress of human wisdom.

"As science develops new powers, man assumes new duties," she said.

The centre, built beside Edinburgh's Royal Infirmary, also houses the university's department of reproductive biology and the National Health Service endocrinology laboratories.

The centre's primary aim is to bring together university and MRC scientists engaged in fundamental research in reproductive biology and clinicians involved in the care of patients with reproductive problems.

These were not new, said Mme Veil, and had always been experienced in a dramatic fashion—sometimes leading to suicide.



Dr John Altken, a Medical Research Council scientist, shows Madame Simone Veil, president of the European Parliament, the equipment used for research into a contraceptive vaccine at the new £1m centre in Edinburgh.

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"The discrimination suffered by women and the secondary rules accorded to them in some instances in modern society cannot be attributed to physical weakness. We all know that women are, if not physically stronger, at least more resilient—a phenomenon which apparently begins after conception."

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North American News

New hope for blacks to reach the zenith...

from Clive Cookson

WASHINGTON The United States Supreme Court concluded the 1979-80 law term by giving its broadest endorsement so far of "affirmative action" programmes designed to favour blacks and other racial minorities. The justices decided by a 5-4 majority that Congress acted constitutionally when it passed a law in 1977, reserving 10 per cent of a \$4 billion public works programme for minority contractors.

In terms of clarity the ruling was a second major force for the celebrated case of *The University of California v Bakke* two years ago. The Supreme Court's opinions were so confusing and so divided that even universities got little guidance about how far their affirmative action could go, and other types of institution received almost no help.

The first step came in the *Weber* case last year when the court upheld a private employer's affirmative action plan which reserved half the places on a company training scheme for black workers. The court and employers could give preference to blacks—or even maintain racial quotas—in order to eliminate manifest racial imbalances in the workforce.

In *Bakke* the court had ruled that the University of California placed for minorities at its Davis Medical School because there was no clear history of discrimination or racial imbalance there.

"We reject the contention that in the remedial context the Congress must act in a wholly 'colour blind' fashion," wrote Chief Justice Warren Burger, giving the majority opinion in last week's case. *Fullilove* against the Secretary of Commerce.

Justice Burger, who had come down against the Davis Medical School's affirmative action plan in *Bakke*, said the 10 per cent set-aside was justified because "Congress had abundant evidence from which it could conclude that minority businesses have been denied effective participation in public contracting opportunities by procurement practices that perpetuated the effects of prior discrimination."

Although the *Fullilove* ruling does not apply directly to education, its indirect effect will be to impose strong affirmative action requirements on universities. In the present political climate there is not much likelihood of that happening, but the pendulum could swing back towards more civil rights activism from Congress.

Lawyers disagreed on the important question of whether, in the absence of a specific law from Con-

gress, federal agencies such as the Department of Education could use the *Fullilove* decision to justify stronger affirmative action programmes.

Whatever its effects in other areas, the favourable outcome of *Fullilove* will encourage the government to direct more support to businesses owned or run by minorities. Federal agencies have in fact been making an effort to help minority firms since the mid-1960s, but their main activity has been to make capital available for blacks and Hispanics to start small businesses in the retail and service sectors of the economy.

The results have been disappointing. The gross receipts of all minority businesses in 1978 came to less than 1 per cent of the national total, and their average annual turnover was only \$40,000. Even the largest black-owned companies are concentrated in the retail and service trades, which are characterised by slow growth and low profit margins. They are almost absent from high-technology manufacturing industry. Black businesses have suffered from poor locations and limited access to the general (white) market, and everyone agrees they have been plagued by managerial incompetence and inexperience.

Nor have minorities done well in the upper echelons of white corporate America. They are virtually un-

represented in the boardrooms and executive suites. The few blacks who have made it to the vice-presidential level in big companies are usually in charge of public relations, personnel or affirmative action, roles which are seen as highly visible, but far from the heart of corporate policy-making. No major corporation has ever had a black chief executive.

As a result of the slow progress so far, government policy-makers are moving away from the old practice of aiding small minority-owned retail and service enterprises on a rather indiscriminate basis.

Richard America, senior policy adviser in the United States Small Business Administration, wrote in the latest *Harvard Business Review*: "A new view has taken hold within the bureaucracy that federal policy should emphasise the creation and development of minority businesses that stand the best chance of becoming large and economically significant; it should also generate more substantial private and public purchasing and investment opportunities from minority businesses to benefit from."

If the new policy is to succeed, and indeed if minorities are to make progress in business generally, it will be necessary to increase the supply of trained minority managers. Until recently business schools have not taken as much interest in minorities as, say, medical and law

schools and, conversely, talented young blacks have focused on careers in law, medicine and education, rather than business.

Now, however, many business schools are making up for their past neglect by putting on special programmes for minorities. The Consortium for Graduate Study in Management, with headquarters at Washington University in St. Louis, led the way. It raises nearly \$1m a year from companies and foundations, paying the money out in MBA fellowships for blacks, Hispanics and Indians at the six participating institutions. The Council for Opportunity in Graduate Management Education is a newer group of 10 business schools modelled on the consortium.

Typical of the efforts individual schools are making is Babson College, a leading undergraduate business school in Massachusetts. Babson was alarmed by its falling black enrolment—down from 40 in 1974 to 25, or less than 2 per cent today—that it recently set up a full-time minority affairs office to improve the life of its black students and recruit more in the future. An important part of the recruiting drive is to bring black high school pupils to the college for up to a week at a time to show them the attractions of a career in business, preceded by an education at Babson.

... and Slaughter takes top job

The top job at the National Science Foundation has gone to John Slaughter, a black electrical engineer who is currently academic vice-president and provost of Washington State University. He will be the first non-white director of the NSF, the main federal agency supporting basic scientific research—it is roughly equivalent to the Science Research Council in Britain.

The White House had to press Dr Slaughter hard to get him to accept the NSF directorship. For he had left Washington DC only last summer, after serving as assistant NSF director for astronomical, atmospheric, earth and ocean sciences, and he was apparently unwilling to move back from the West Coast so soon.

But the prestige of the job eventually persuaded Dr Slaughter, 46, that it was worth taking. After his six-year term he can reasonably expect to become one of the first black chairs to head a major American university.

The Carter Administration hopes the appointment will boost its efforts to increase the number of

blacks and other minorities going into science and engineering.

Ronald Reagan could in theory fire Dr Slaughter if he wins the presidential election, but he is unlikely to do so, first because the NSF directorship is supposed to be a non-political post, and second because Reagan would probably not want to risk alienating American blacks (who are not likely to feature prominently in a Reagan Administration).

But Dr Slaughter might find life uncomfortable under Reagan if he looked at the NSF budget of more than \$1 billion a year as a prime target for government spending cuts. So far Reagan has revealed nothing about the science policy he would pursue as President, and he may not even have thought about it.

"Everybody over here is as happy as hell about it," said an NSF spokesman, describing his colleagues' reaction to their new director. "He is a hell of a nice person and a good administrator."

The Senate must now confirm Dr Slaughter's appointment, but no opposition is expected.



Dr Slaughter: pressed hard.

Some tests now gaining in importance

Despite the recent wave of standardised tests and scholastic aptitude tests, the SAT, the most widely used of these, is not the only one. The SAT is a general test of verbal and mathematical skills, but it does not measure specific knowledge or skills. The SAT is a general test of verbal and mathematical skills, but it does not measure specific knowledge or skills. The SAT is a general test of verbal and mathematical skills, but it does not measure specific knowledge or skills.

Colleges say they are looking for students who have demonstrated achievement in a variety of areas. They are looking for students who have demonstrated achievement in a variety of areas. They are looking for students who have demonstrated achievement in a variety of areas.

Mr Williamson was one of the 100 high school graduates who were selected to attend the SAT. He was one of the 100 high school graduates who were selected to attend the SAT. He was one of the 100 high school graduates who were selected to attend the SAT.

Underlying much of the discussion was the attack which directed by Ralph Nader, summer advocate, and other college admissions tests.

Whatever doubts may be raised in the public's mind about the fairness of the SAT, the fact remains that it is a kind of scientific test. It is a kind of scientific test. It is a kind of scientific test. It is a kind of scientific test.

People are moving away from the SAT. They are moving away from the SAT. They are moving away from the SAT. They are moving away from the SAT.

The value of the SAT is being questioned. The value of the SAT is being questioned. The value of the SAT is being questioned. The value of the SAT is being questioned.

Mr Jovett attributed the decline in the SAT's reputation to the fact that it is a kind of scientific test. It is a kind of scientific test. It is a kind of scientific test. It is a kind of scientific test.

Overseas News

Students finish early to help in Olympics

from Michael Binyon

MOSCOW The Moscow Olympics would have been possible without the help of thousands of students, the use of universities and hostels and the participation of scores of student athletes.

Higher education establishments throughout the Soviet Union ended the academic year a month earlier than usual this summer and have been turned into makeshift hostels and youth hotels for the Olympic visitors. All examinations were brought forward to allow specially shuttled year, and overseas students found they too were sent home early.

Meanwhile some 85,000 students have been assisted part-time summer jobs to help cope with the expected influx of 600,000 Soviet and foreign tourists. Some 17,000 are working as cooks, 22,000 as waiters and hotel staff, 9,000 as guides, 2,000 as helpers at the sports complexes and the others in office jobs.

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Most western tourists will be put up in the vast new hotel complexes the Russians have built. Although few visitors are now expected from the United States, Japan, West Germany and other boycotting coun-

tries, the Russians are still hoping for a large turnout of visitors from overseas, and students will play an important role as interpreters. However, all those assigned to deal with westerners have been carefully chosen for their political reliability. They have also been instructed on how to behave, what answers to give and what to expect. One student from a Moscow institute who is working as a porter said he and his companions had been warned against saluting tips, though were told they could accept anything offered.

There seems little likelihood that Soviet students or academics will make use of the opportunity to engage in any widespread discussions with the western visitors. And Soviet security police have already begun a thorough screening of all visiting tourists to ensure that no books or manuscripts considered subversive are brought into the country.

Many students have been engaged in helping builders get the city ready for the games, and even university lectures have been interrupted in order to report for duty in the Herculean effort Moscow is now making to tidy up and clean up.

Many of the Soviet athletes themselves are officially described as students, though they have received surprisingly generous leave during the past summer to enable them to get into training for the games.



Olympic souvenir shops are relying on student help

Fund recovers from BOSS spy scandal

from Alan McGregor

GENEVA The International University Exchange Fund, still shaky from the crisis that hit it at the beginning of this year, is struggling to reorganise and keep itself a going concern for the sake of the 3,000 students of 60 countries in Southern Africa—whose scholarships it administers.

Funding over the next three months, 10 million Swiss francs, (£2.5m), is being provided by the Swedish government, while the IUEF completes the reorganization and works out guarantees to satisfy the other main donors—Denmark, Netherlands, Norway and Canada—the money they provide will be used to maximum advantage for the purposes they stipulate.

"A severe blow", is how the fund's acting director, Mr Hassim Souleimani, 41, of Geneva, now refers to the events in January when it was learned that the deputy director, Craig Williamson, was not the white South African anti-apartheid campaigner and exile he purported to be but instead a covert agent for the South African security police.

Williamson, who departed abruptly from Geneva and returned, via London, to South Africa, in the third week of January, took back with him to BOSS headquarters in

Pretoria details of fund activities and contacts during the three years in which he had been employed by the organization.

Being compromised to this degree was a disaster for the IUEF, which had to find off some bodies, particularly as Williamson, 31, enjoyed the full confidence of many of the people he met while based in Geneva.

The validity of the fund's purposes has been severely shaken, and supporting countries have been alarmed. At a meeting earlier this month in Copenhagen, their commitment to the students now under its wing. In addition to those from Southern Africa, there are 500 in Latin America, with the vast majority in African countries or in Europe.

But the Danes stipulated that further contributions were conditional on IUEF re-organising by their standards required by their governments' auditors, with the other main donors—Denmark, Netherlands, Norway and Canada—the money they provide will be used to maximum advantage for the purposes they stipulate.

Mr Souleimani, who was his country's ambassador to Sierra Leone and nine years with the OAU secretary before being appointed IUEF regional director for Africa in 1977—based at Lusaka—has had to cope with a severely demoralized staff since he arrived in Geneva in Febru-

ary, as well as a four million Swiss franc (£1m) deficit, accumulated since 1974, on an annual administrative budget of some three million Swiss francs.

In addition to staff cuts, he talks about the necessity of moving to a smaller office, though by Geneva standards the existing one is by no means pretentious. "I am optimistic that the donors will remain sympathetic to the IUEF's cause," he said. "Education is a strong anti-apartheid movement, for without it you cannot fight."

While he admits there was a lack of adequate management in the organizations affairs, including over-spending on travel and communications, he accepts that Williamson's infiltration into the heart of their activities was simply a betrayal of the trust put in someone who had come to them after being vice-president of the anti-apartheid National Union of South African Students—before he crossed into Botswana in 1977, claiming he was being harassed by BOSS.

What has not happened to the IUEF—so far any way—some dramatic BOSS action against any of its scholarship holders, not even the handing over of students to the South African security police.

Williamson's information, however, must certainly be a potential threat to some.

Call for freeze on enrolments

Italy's impulsive health minister Aldo Aniasi attacked another Italian minister this month when he suggested "freezing" this year's medicine enrolments.

This came just a week after he appealed to secondary students sitting for their "A" levels to stay away from overcrowded medicine faculties.

Signor Aniasi argued that freezing all medicine enrolments would give faculties a respite and eventually reduce the 33 per cent unemployment rate of the nation's medical corps (which claims to have about 50,000 doctors out of jobs).

But academic sources suspected the minister's proposal was more devious. They said he really hoped students who could not enrol in medicine this year would choose another career.

The freeze-out "is being studied by Parliament and first reactions are not very favourable."

"It would gravely damage fundamental rights and discriminate against a class of young people who this year have obtained their 'A' levels, a group of senators from the ruling Christian Democrats wrote to the education minister.

The Aniasi proposal was not the only unusual scheme advanced to solve the problem of congested medical faculties and the lack of jobs for young doctors. In Milan, Gaetano Grassani, president of the administrative council of the city's largest hospital, advocated the use of medical students above the third year as nurses for the mentally sick.

Signor Grassani, whose proposal was hailed by one newspaper as "inspired by Anglo-Saxon pragmatism", said such a measure as a temporary solution for a shortage of psychiatric nursing staff.

Italian hospitals have been overcrowded by psychiatric cases following a law 18 months ago which closed the mental asylums, and decreed that the mentally ill have the right to be treated at public hospitals.

"Even if we are optimistic it will take at least five years before we have sufficient professional nurses to look after the mentally ill. In the meantime these students could help out," Signor Grassani told an assembly of public health officials.

Signor Grassani's proposal is also being studied by Parliament but the first reaction from Milan's 17,000 medical students was rather positive. "It could be interesting and we'd be paid for it," said a student spokesman.

Four-year plan to aid research

from Guy Neave

PARIS France must make more efforts to boost university based research. This is the main conclusion of the research committee set up to prepare the broad outlines of the next four-year plan, to run from 1981 to 1985.

Chaired by M. Pierre Laffitte, director of the Ecole Supérieure Des Mines de Paris. The committee is particularly concerned at the relatively low commitment of both universities and the elite *Grandes Ecoles* to applied research. This, the committee pointed out, is well below the level found in Germany, Japan and the United States. One of the main priorities of the VMIH plan must be to rectify this situation.

Taking a hard look at the development of R and D during the past ten years it is apparent that research has accounted for a falling percentage of the Gross Domestic Product. In 1968, for instance, some 2.3 per cent of GDP was given over to research and development. By 1973, this had fallen to 1.3 per cent. The drop has been especially noticeable in the public sector where researchers have faced a well known continual fall in the funds available.

No less worrying is the massive differences in the role of R and D between different industrial sectors. In electronics and pharmaceuticals, research accounts for between 15 and 20 per cent of the value added but less than 0.3 per cent in agriculture.

Another concern, of particular interest given the conclusions of Britain's Finiston report on engineering education, is the apparently low volume of research carried out in these institutes of higher education—both universities and *Grandes Ecoles*—involved in engineering education. Another weak point in the research effort, the committee suggests, is also to be found in medical research. Professors of medicine are not always qualified in research while researchers in this area are not guaranteed in finding a place in the medical profession itself.

The committee made a strong plea for a major increase in funding for all areas of R and D, to reach 3 per cent of GDP by 1985. The proportion of the gross domestic product set aside for research should be raised from 1.8 to 2.3 per cent. The implication is that research expenditure must grow by 8 per cent a year in the course of the next four years if France is to catch up with Germany and the United States.

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Food scandal scraps image of science academy

The National Academy of Sciences used to stand above the dirt of public controversy, but during the past decade the American counterpart of Britain's Royal Society has been dragged into a series of scandals, most inevitably, has sunk to a level where its once venerable reputation is quickly becoming stained by flying mud.

This year the NAS issued two particularly controversial reports that drew unprecedented venom from press, public and politicians. Many observers fear (or gloat) that the academy's reputation has now been seriously damaged.

The first was a huge report—produced at great expense and a year behind schedule—by the Committee on Nuclear and Alternative Energy Sources (known as CONAES). It dismissed solar energy as "a commercially viable power source for the rest of the century without giving adequate scientific evidence for this conclusion."

The nuclear industry was pleased, but environmentalists and alternative energy lobbyists made damaging allegations about the committee's composition. The SPEK, chairman of President Carter's Council on Environmental Quality, commented in the *New York Times* that CONAES was "back of the envelope calculations and the ex-

posed benefits and some serious public relations damage was done by the academy's food and nutrition report. It took a strong stand against

food fads, saying in effect that the evidence about the impact of diet on health is so inconclusive that Americans should feel free to eat what they like. In particular the report said normal adults need not worry about the amount of cholesterol in their diet.

That recommendation contradicted the conventional medical opinion that everyone should cut cholesterol consumption in order to prevent heart disease, and it drew an extraordinary barrage of criticism not only from the press and politicians but also from a wide range of scientists.

Unfortunately the academy has been less about the substance of the report than about the integrity and makeup of the board. The critics have discovered that the report was funded entirely by contributions from the food industry and the several members of the board, including the two who played the biggest part in writing the report, were consultants to food manufacturers. Worse, from the scientific point of view, was the fact that no epidemiologists or cardiologists were involved.

The *New York Times* called the commission report "an exercise in self-interest and self-protection." It was a national disgrace, said the *Washington Post*, and the reputation of the board and the academy for rendering careful scientific advice. The board's chairman, Philip Handler, resigned as a result of the report, and prominent members of the board, including the two who played the biggest part in writing the report, were also criticised.

The academy's food and nutrition report, it took a strong stand against

that people should eat less animal fat.

Soon the criticism spread to the wider world. The NAS as a whole and to the Blochman Institute, headed by the past 11 years, president Philip Handler. Under his leadership the academy has expanded into an impressive bureaucracy, with some 1,000 committees producing 300 reports a year. In addition to its own staff of 1,000 the NAS uses 9,000 outside scientists to fill its committees, subcommittees, board and panels.

Although the academy is a private charity from the United States Congress, it is not exempt from the government's science and technology policy. The NAS is a private charity from the United States Congress, it is not exempt from the government's science and technology policy. The NAS is a private charity from the United States Congress, it is not exempt from the government's science and technology policy.

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Economy defeats grants committee's intentions

from Lindsay Wright

WELLINGTON The University Grants Committee (UGC) is no longer, according to the annual report of the University Grants Committee tabled in New Zealand's Parliament.

The committee, recalling the concern expressed last year about declining staff: student ratios and the hope it then had to effect an improvement in the new quinquennial, admits that the prevailing economic climate has defeated its intentions.

The overall staff: student ratios have now fallen below those of technical institutes and teachers' training colleges in New Zealand. No other educational institution has had to cope with such markedly increasing falls together with declining staff: student ratios as have the universities.

The universities have met the situation by the disestablishing staff positions and reallocating to areas of greatest shortage. This is a slow process, as staff are most vulnerable in areas of greatest shortage, such as engineering, mathematics, com-

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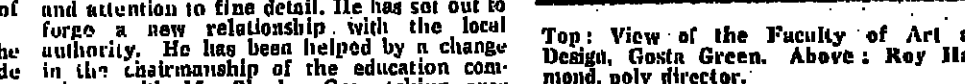
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Soviet psychologists deny slipping towards Freud

Sigmund Freud's method of psychoanalysis is a callous violation of the human psyche, claim Soviet psychologists.

Polytechnic Profile- Birmingham

New director brings ring of confidence



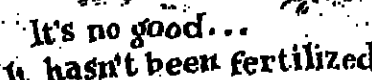
Business is booming at Rome's British School but cuts loom. Uli Schmetzer reports on the dilemma

Money for art's sake

[illegible]

American morale is at a low ebb, says David Saxon

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John C. Ho

BOOKS

Our syphilitic army

Colour politics

BOOKS

Fresh insight into environmental ambivalence

The Woe of Earth: new perspectives on man's use of nature
by René Dubos
Athlone Press, £7.50
ISBN 0 485 11209 4

"Thinking Thoreau" is not René Dubos's phrase; nor, I think, was it his intention to debunk Thoreau in this book. But it is the theme that started up in my mind as I read the book. Thoreau's love of Nature was anthropocentric. He wanted to preserve the wilderness for his own pleasure, out of self-interest, not out of respect for any intrinsic value of the wilderness. When Thoreau disapproved about wild Nature in an article in the *Atlantic Monthly* he was, as Dubos reminds us, "living in Concord, Massachusetts, a very civilized township where the wilderness had been completely tamed. He loved the out of doors, but knew little of the real wilderness." Anyone who has not just a piece of untamed Nature, but has really lived in it, knows that it is not comfortable, and it is often not beautiful in the eye of the beholder. Even Thoreau could not stand more than a couple of days of wilderness. The scenery of Maine struck him as "savage and dreary".

Is there a streak of hypocrisy in the humilities of conservationists? Dubos doesn't call it hypocrisy; he is too humane for that. He calls it "environmental ambivalence". On one hand we plead for the preservation of tropical rain forests and frozen tundra; on the other we fight passionately to preserve the mammoth, defunct, Vale of Belvoir, the charnel-house and drained wetlands that have become a mammoth East Anglian landscape, the grazed and barren Downs of Sussex; all examples of Nature exploited, wilderness destroyed.

The main device in the main theme of Dubos's book has been written by someone addicted to material progress, industrial growth, and motorways, power plants, and mines, conservationists could have dismissed it. But René Dubos is a guru among conservationists, and his book is a masterpiece of lucid, clear, and convincing argument. He is the first of the 1972 United Nations Conference on the Environment at

Stockholm. With Gallic clarity and with the skill of a biologist, he dissects out what we really mean when we talk about "areas of natural beauty" and what we really want when we campaign for the preservation of rural England and Wales; the spectacle, as Dubos puts it, "of cattle pasturing in meadows, hedges flittering with song birds, and other bucolic scenes that we mistakenly regard as manifestations of undisturbed nature". Dubos has the honesty to assert that the partnership between humankind and Earth has generated values that transcend those created by natural forces working alone. Of course this assertion rests on an arguable assumption, namely that the only values that matter are values of Nature, and that ecosystems apart from humankind have no intrinsic worth. To this extent Dubos is as anthropocentric as Thoreau was.

But Dubos develops the theme with more insight than Thoreau brought to it. The word "wilderness" has only recently become an object of concern (and, to some people, of misdirected affection). It occurs, says Dubos, some 300 times in the Bible, "and all its meanings are derogatory". When humankind first entered the American continent from the Mayflower he described the virgin forest as "hideous and desolate wilderness". The annual feast of Thanksgiving celebrates the destruction of this wilderness and its conversion into fields of corn and pastures for cattle. This hostility to wilderness makes sense biologically, for modern man is genetically coded to live in environments which he has tamed and exploited. He calls this "improvement", "management", and "improvement". (I'm reminded of the lady who said her cat had been "improved", meaning it had been neutered). Dubos eloquently defends this management of Nature; he calls it the humanization of the Earth. The process began in the Stone Age between the Euphrates and the Tigris. It has continued ever since. The notion that communities have ever lived "in harmony with Nature" is false. Clearing forests, burning undergrowth, terracing hillsides, hunting game; these have been basic human activities in all parts of the Earth settled by man.

It was not until the nineteenth century that city dwellers began to want to escape from cities and to seek solitude and tranquillity in the countryside. So-called "wild" regions (the Lake District in England, the Alps in Switzerland, Yosemite in America) acquired a value to man which they had not had before. William Cobbett's animadversions against "the Great Wen" gnawing its way into the lanes of Kent and Surrey; Wordsworth's suggestion that the Lake District should be nationalized; Clifford Pinchot's appeal for forest reserves in the United States; these were warnings that the time had come to put some restraint upon the exploitation of Nature by man. By the turn of the century the conservation movement was well under way. Conservationists did indeed display "environmental ambivalence". They fought, as they still fight, to preserve those aspects of Nature which were agreeable to man; this included some wild places and some wild animals, but it included also many places where man has "improved on nature". Dubos does not believe that "Nature knows best" in the design of natural ecosystems.

It is on this point that (in my view) Dubos himself becomes somewhat ambivalent. Many natural systems, as he writes, "represent clumsy solutions to ecological problems, even when Nature has been left undisturbed". He believes that the wisdom of Nature is at times shortsighted. He justifies this surprising statement by reference to the violent ups and downs in populations of lemmings and other rodents, and in the accumulations of coal, oil and guano, which he regards as massive interruptions in the recycling processes of Nature. For a few pages Dubos slips into a dubious kind of teleology. True, biologists had been given charge of creation, they might have arranged matters so that there would be less waste of pollen, a lower infant mortality among birds, devices to obliterate ho-bocous among some mammals. But, as other naturalists have observed,

biologists might have been too clever by half: they would surely have made DNA stable and not liable to accidents; in which case there would have been no evolution at all. It is just as well that the design for Nature was not undertaken by biologists. To say that man can improve on Nature for his own ends is defensible. To say that man can improve on Nature to Nature's own benefit is not. In praising parks, gardens and farmlands as pleasant improvements on Nature for the use of man, Dubos is on firm ground. But he ought, surely, to have added some warning about the hazards of such improvements, such as vulnerability to disease among the monocultures. The diversity in ecosystems is one sign that Nature does know best.

Dubos's book is not a sustained development of the theme of environmental ambivalence. It is a compilation of lectures and articles, some of which have already been published; so the chapters are inevitably somewhat disjointed. He does deal with some other themes; two of them are worth some comment.

The first of these is the problem of man's responsibility for Nature. Dubos quite rightly rejects the over-quoted assertion by Lewis Mumford (in *Science*, vol. 155, 1967) that "Man's attitude to Nature rests on God's instruction in Genesis 1:28, where Man is given dominion over Nature. If anyone is responsible for this attitude it is Bacon or Descartes."

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Lord Ashby of Brandon is Chair of Queen's University, Belfast, and a Fellow of Clare College, Cambridge.

Eric Ash

Macromolecular fundamentals

Macromolecules: an introduction to polymer science
by F. A. Bovey and E. H. Immergut
Academic Press, £22.00
ISBN 0 12 119755 7

The contributors to this volume are all polymer scientists at Bell Telephone Laboratories in Murray Hill, New Jersey. Bell Laboratories has the reputation of being the pre-eminent materials research organization and much very fine polymer science research has been carried out there during the past 25 years. In view of this one expects something rather special from this book.

The problem in teaching a general polymer science course to, for instance, chemists, is to cover the preparation, characterization, and properties of polymers without getting bogged down in the quantitative background material on the physical and chemical science aspects and without turning it into a rather tedious and over-simplified treatment of a number of isolated topics. In this case the authors have set out to force the reader to confront the fundamental aspects of macromolecular chemistry and physics, and have avoided not technological material.

The first chapter, by Bovey and Immergut, is a brief summary of the state of the art of polymer science and a short history of polymer science. Chapter two, by E. H. Immergut, which fills about a third of the book, is an excellent review of polymerization processes with a thorough treatment of kinetics and molecular weight effects. Chapter three, by Bovey and Immergut, describes the physical and chemical properties of polymers. Chapter four, by Bovey and Immergut, describes the physical and chemical properties of polymers. Chapter five, by Bovey and Immergut, describes the physical and chemical properties of polymers. Chapter six, by Bovey and Immergut, describes the physical and chemical properties of polymers. Chapter seven, by Bovey and Immergut, describes the physical and chemical properties of polymers. Chapter eight, by Bovey and Immergut, describes the physical and chemical properties of polymers. 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Paul Calvert

Cosmical magnetism

Cosmical Magnetic Fields: their origin and their activity
by E. N. Parker
Oxford University Press, £45.00
ISBN 0 19 851290 2

The boom in theoretical astronomy goes on. Of course, the subject is still in its infancy. There are several different styles of reason. For example, physics—for example, general relativity—stands at one extreme. Here any theory has to have a proper formal structure. At the opposite end of the spectrum is the problem of explaining the exotic objects that have been detected. Where observations are sparse there is no point in devising over-elaborate models. In between are those branches of astrophysics where the basic theory is well understood and the detailed observations are available. For instance, small scale features which are observed directly on the sun may be used to construct theoretical models that can then be checked by comparison with other stars. Such problems call for thorough analytical or numerical investigations.

Cosmical magnetic fields provide an obvious example. Magnetic fields have been mapped in detail on the sun and, as observational techniques improve, they are being mapped on other stars. Such problems have not been little, as they have been demonstrated. Yet, they have been struggling to keep up with the observations. As Professor Parker says, "the sun is a laboratory for the study of other stars. Such problems call for thorough analytical or numerical investigations."

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fully convincing theory of the sun's cycle. Further difficulties arise in extrapolating from the sun to other stars and in explaining planetary or galactic magnetic fields.

Professor Parker has been a pioneer in this subject. His monograph has three main purposes: first, to discuss the origin of magnetic fields in stars and planets; second, to review the state of the theory; and third, to record the contents of some 80 of his papers, written over the past 20 years. So it is not surprising that his book is long (680 pages) and that it is a bit of a labor of love. It is a pity that the authors have not been able to cover the mechanical properties of polymers in more detail.

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There is an excellent chapter

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Continued on page 7

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The desk calculator that grew

There is need for a wide variety of approaches to computer studies, says D J Howarth

The subject of computing science is a relative newcomer to the field of education. Although computing in its most general sense has been known and practised since the earliest days of civilization, the study of computing science relates to the use of stored-program computers to solve a wide variety of problems, and this use first developed some 30 years ago. The study of computers and their use was only introduced into teaching programmes within the past 20 years, and since its introduction, it has grown remarkably in scale at university, polytechnic, and, more recently, at school level. In keeping with the rapidly evolving subject material, the educational material has changed considerably during this short period, and inevitably will continue to do so over the coming decade.

A computing system is a tool to assist in the solution of problems. In the early days of development of computing systems, the most complex and technically advanced part of the system was the processor, and hence the problems tackled were those problems, mainly in science and engineering, which demanded complex or voluminous computation. The computer was a rather advanced desk-calculator, and its role in problem solution was exactly that of a desk-calculator. As capability to store and manipulate large amounts of data increased, and distributed key-board communication became possible, computing systems were increasingly employed in problems involving storage, manipulation, and access to large banks of data. Problems which are common place in any highly developed society of people.

Thus the computer became not only a tool to solve problems expressed in mathematical terms, but became an important tool in business and commercial organizations. Increasing cost-effectiveness has led to a continual expansion in this role, so that computerized record-keeping is common place and access to recorded information is likely to be possible not only by record-keepers but by the general public—computerized telephone directories are a distinct possibility. The general public are also increasingly aware of the impact of the micro-computer which can now provide a cost-effective replacement for a wide range of mechanical and manual tools used in process control and in elementary information handling.

The subject of computing science is a study both of the nature of computing systems and of the use of computing systems. Each of these areas of knowledge embrace hardware and software components. Computing systems include processors, stores, and communication components, but also involve an increasing software component in the form of operating systems, translators, and data management programs. The application of systems involves not only the construction and execution of

programs, but the interfacing of the system to hardware components of the application area. It must be recognized that the two subject areas defined above are not to be equated, as was once the case, to hardware and software.

The growth in application areas, and the continued development of systems to exploit capabilities of new technology and to match new requirements, both imply an increasing need for development of knowledge and skills—an increasing need for computer science education. This need results in a pronounced demand for education in computing science, and a diversification of the level at which this demand appears. In the 1960s the most common pattern of computing science education was by means of "conversion courses" in universities, whereby computing skills could be taught to those who had graduated in another discipline.

This pattern has now been extended by the introduction of undergraduate courses in computing science in universities and polytechnics—full time, part time and joint courses combining computing science with another discipline—and by introduction of computing as a significant subject at advanced and ordinary level in schools. It is clear that the demand for education in this area will continue to grow during the coming decade. The rapid growth can be expected to stabilize (continuation of the current growth rate would make computing science a larger discipline in numbers at university level than all other sciences combined).

As in all areas of knowledge, but in particular in a rapidly developing area, there will be need not only for quantity of trained people but for quality—for educated people who can play a significant role in directing the application of computing systems in two areas where there is most need and in developing systems to meet such needs.

In addition to the growth in demand, there has consistently been a growth in subject-matter, as new technology and new application areas have emerged. The new capabilities and new demands contribute to the subject both directly and indirectly in that they call for new techniques of using the capability to meet the demand. Thus there has been, and will continue to be, a diversification of knowledge to be acquired.

In many universities, for example, computing was once taught as an adjunct to mathematics, since the primary role of computing systems was that of calculation. There is now an increasing widespread recognition that computing science includes knowledge of the way societies of people function, of techniques of large-scale data handling, and of knowledge of hardware capabilities and the use of computers in process control environments.

Similarly, translation of source text supplied by users into internal computer codes has long been recognized as an important educational topic: it is now recognized that this problem of compilation is part of the overall problem of constructing a user interface to a machine, and the topic of software development is becoming an increasingly significant component of computer science education.

In a subject of such diversity, it is doubtful whether a single educational pattern is suitable for meeting all demands and to the very capability of the school level, it is probable that a single study simple

solution of problems in numerical mathematics by expressing the solution in languages such as FORTRAN, or Basic. It is also appropriate to provide some level of computer appreciation, so that the idea is given of the range of capabilities and applications of computer systems. It may also prove beneficial to introduce the student at a level to the ideas of rigorous problem specification, which form an important area of advance in engineering of large scale systems.

At university or polytechnic level there is need for a wide variety of approaches. There will be demand for student knowledge in particular disciplines (for example, physics or electrical engineering) with a firm knowledge of the application of computers to that particular discipline.

For such students, joint courses in a conversion course following graduation in the particular discipline are appropriate. Care must be taken not to lose the narrow specialization interpreted as failure to make student aware of advances in field which may have a low impact in the particular discipline. Developments in the nature of computing systems which are a consequence of diverse applications can be expected to have influence in all application areas. The physicist is not well educated in computing science if his education is limited to exposure to use of computing systems in the same way as the student in 20 years' time will be a demand for "software engineers"—students who are aware of the software needed to support effective user interfaces, and who have some knowledge of the developing techniques of production of such software. This subject area is of growing importance as costs of software provision contribute an ever higher proportion of overall system cost, and is a rapidly developing subject area, involving accurate specification of modules, proof of correctness of algorithms, and a general raising of level of problem definition.

The well recognized importance of the software components of computing systems does not remove the need for education in hardware engineering. As the subject material grows, there is likely to be increasing specialization in the pattern of education, both to meet the demand for graduates and to cater for the student aptitudes. Courses in computer engineering (divided up by increasing availability of hardware components), software engineering, and data processing will develop, perhaps with the establishment of powerful centres of excellence in these areas. In emphasizing the growth in the subject of mathematically expressed problems, it should not be supposed that this area itself is static.

Problems abound in science and engineering—for example, in weather forecasting, in the design of aircraft, in the design of application areas where the computer system is used to simulate a complex or experimental situation—where the development of advanced techniques of computation, and education in this "classical" area of computer science is a continuing requirement. The intellectual excitement of exploring new subject areas must not detract from the importance of the challenge of this continuing and important role of computing systems.

It is to be hoped that there will also continue to be courses providing broad cover of the basic area, for these can provide a basis of highly educated graduates who can apply their capabilities to a wide area of needs. In many ways, computer science is a skill to mathematics in the breadth of opportunities it offers and the education value of the discipline, and it is hoped that the vocational value of computer science will, in some way, be matched by its value as an avenue of general education. Those involved in the exciting prospects of the development of the subject should be equally excited at the opportunity to use the subject as an avenue to develop as a well-rounded graduate capable of taking a leading role in the overall development of the world society of which they are a part.

The author is professor of computing science at Imperial College, London.

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MICRO-COMPUTERS IN HIGHER EDUCATION

Computers are becoming more manageable and essential to every lecturer, says Diana Laurillard

As computers become smaller, cheaper and more widely available, so it becomes more likely that every academic research project will have its own computer. Almost no research area is so remote from mathematical computation that computers cannot be used somewhere. They become more and more a part of every lecturer's life, and more as such a miserable occurrence as it once was.

Those who have ventured to do their research data analysis via the batch processing mode of the large computer may well have decided that computers are to be avoided. But they are becoming more manageable now that micro-computers can be under the control of the individual academic. Computers are now genuinely personal. This new development has some implications for undergraduate teaching, because where computers are usable in research, they can enhance the teaching of that subject as well. And they can enhance it in a way which is entirely different from any other teaching method.

Many of us, when we want to learn how some mechanism works, simply play around with it. There are a number of different strategies of approach, such as trial and error, systematic hypothesis testing, taking it to bits, or even taking it to bits and putting it together again. Some strategies are better than others, but they all have in common the characteristic that the learner manipulates and controls the system, and learns about it through the feedback of the results of his manipulations.

Now consider the student trying to grapple with an abstract mechanism. The only way he can perform this kind of manipulative play is by using some often complicated, or at least lengthy mathematics. The student may be a good mathematician, but he may still tend to forget the conceptual meaning of the mathematical operations. Even the relatively simple mathematics of some economic models could frustrate the student's attempt to obtain a global picture of the interaction of all the different economic factors. How much easier it would be to understand such a model if he could see instantaneously the effect of certain changes in, say, the money supply.

The point of using computer simulations in undergraduate teaching is to liberate the student from the intricacies of the mathematics, and allow him to concentrate his attention on the high-level control of an abstract mechanism. He can investigate how it operates, try out different configurations, explore it in detail or as a whole.

Usually, a computer simulation is implemented on a computer linked to an interactive terminal. The terminal has a keyboard, which allows the student to communicate

A strictly personal part of life

with the program by typing in letters or numbers. Feedback will be in the form of words, letters, pictures or graphs displayed on a screen. The hardware is standard, the kind that can be found on any university or college campus.

The computer program itself, which simulates the mechanism, will be based on some kind of mathematical model. It may be a system of equations, or it may simply be a data-base, depending on the subject matter. The software is not so standard. It must be specially written. But, even here, the difficult parts of the programming will usually have been done by someone somewhere for research purposes.

Computer simulations used at research level can often be highly complex, and may be inappropriate for teaching the subject. The use of simulations with undergraduates is a matter of degree. A single equation with half a dozen different parameters could provide a student with an hour's work in exploring the effect of each parameter on the system. And the display of a single equation is quite straightforward to program.

The power of a computer simulation to enhance conceptual understanding lies in the interactive nature of the student's use of the program. It is quite different from the experience of a lecture. In a lecture, the student is passive. The teacher is in control of the pacing and ordering of the presentation of information. And that is often a perfectly adequate way to communicate conceptual ideas verbally. But for the student to grasp these ideas fully, for him to "make them his own", there has to be some point at which he directs his own thinking in relation to the subject matter. If any one of us were to be asked how we came to real understanding of some idea, it is almost certain that the process involved at some point, the conceptual equivalent of playing—seeing what would happen if... applying the ideas to some familiar situation, experimenting with some new way of doing things.

In using a computer simulation, the student not only has control over the pace and order of the information, he also has control of the system itself. And this means that he has to direct his attention towards interpreting the symbolic or figurative information presented, towards the relation between different

aspects of the system, towards an evaluation of the outcome of his input, towards decisions as to what it might make sense to do, towards the relationship between the mathematical model and the behaviour of the system, and so on. And the combination of all these activities is the kind of conceptual "play" that is necessary for understanding. It is easy enough to see applications for this kind of learning in the science and technology subjects. A range of examples have been investigated under the auspices of the former National Development Programme in Computer Assisted Learning (NDPCAL). At the University of Surrey, the use of CAL has been campus-wide for some time and several courses provide numerous examples of its use in the simulation mode.

In the field of streamlines in potential fluid flow in mechanical engineering, a student would normally be given a diagram of the various streamlines and their associated equations. With a computer simulation Dr David Pollard's students can generate their own stream functions, selecting which equation to use, and choosing suitable values for the parameters. As the computer simulates the streamlines, the student's attention is directed towards the relationship between the equation, the particular parameter values and the shape of the resulting streamlines. The simulation package is that it encourages the student to think about the important aspects of the content.

The social sciences have long made use of computer simulations, but they can be equally useful in teaching. To give sociology students some insight into the differences between the various survey sampling methods, Dr Nigel Gilbert has written a program to allow the student to survey the same population in four different ways. The program does the work of generating and analysing the results. The student is left to concentrate on the higher level aspects of deciding how to apply the methods and then evaluating the results of the analysis. One day they will have to trudge the streets, clipboard in hand, if they are to learn the mechanics of the experimental work are like. But when they want to compare and contrast statistical methods, the computer simulation is more effective.

The advantages of a simulation are particularly apparent when the real thing is difficult, dangerous or time-consuming. One of the most well-known examples in the field of medicine has been developed at the University of Glasgow: practising diagnosis on a computer-simulated patient is a lot safer than practising on a real one. The same is true of management. In the hotel catering and tourism management department at Surrey, the students have to be taught how to manage restaurant bookings. Paul Gamble has developed a simulation program to allow his students to practise this on the computer, before they are let loose on the real thing.

Ironically, although a computer simulation is essentially an abstraction from reality, it can often bring the students closer to that reality. It is traditional in many engineering courses to give students an experience of engineering problems by giving them "concrete" identified examples. They have too little time for anything more complicated. But in industry they will have to face the reality of irregular deformation, non-uniform cross-sections, and elastic (if not elliptical) billiard-balls. By making use of data bases developed for research purposes, Dr David Moss has been able to demonstrate in his civil engineering students, the characteristics of flow in a river that does not have a perfectly horizontal and rectangular channel.

The curricula of several subject areas are likely to change, indeed will have to change, if they are to be responsive to the changes in industry. And some of the likely changes will be related to the introduction of computers and microprocessors.

Designing a good computer simulation is a challenge. It is also, potentially, a valuable contribution to undergraduate teaching.

The author is lecturer in computer-assisted learning at the Institute for Educational Technology, University of Surrey.

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This book records the substantial experience of a computer-assisted learning (CAL) project, sponsored by the National Development Programme.

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The Sharp MZ-80K is the perfect beginner's computer for your school, college, or business. It's easy to learn, easy to use, and easy to master. You can learn to program in BASIC, and you can learn to use the many features of the MZ-80K in half an hour. We'll show you how to master it in half an hour.

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MICRO-COMPUTERS IN HIGHER EDUCATION

Getting on to the micro wavelength

continued from page 17

over. Sadly there simply were not enough experts.

In Cardiff we have fortunately avoided personality clashes and have organized teaching so that engineers teach hardware and computing mathematics software. There are two requirements: (i) specialized computer systems degrees and (ii) optional subject teaching on general electronic engineering courses. In no case should there be specialist microprocessor courses for the first year of computer architecture and software practice are required.

By all means use micros as specific examples: discuss the influence of pin-out limitations on computer architecture and in particular stress design concepts around LSI parts and their interconnection rather than more detailed circuitry. The new generation of engineers must be taught to think in terms of blocks and the new concepts of using external timing, status and control pins to construct systems. Many of the new parts are "programmable" another new concept which must be introduced.

For electronic engineering students room must be found in already crowded time-tables for the new software aspects. Something must go. Electronic engineers have no background in computing so that they need introductions to such software tools as editors, compilers and executives. The importance of program structure and modular programming, using a linker, must not be avoided for the easier introduction to assembler language programming. Many of these aspects even in fact be introduced in demonstration and laboratory work.

Complex new computer systems degrees: both hardware and both software can only be introduced in the current climate of staff shortages by making maximum use of existing course modules. We have run such a device scheme at Cardiff for four years and while we could definitely make detailed arrangements with more staff our students are being welcomed with open arms in the new computer industry.

Organizing teaching is very difficult. Not only are different departments involved, but very often different faculties. Time-tabling, examination rules, etc. are different. Add to this the vested interests of individual people and departments and the scene is somewhat discouraging and very inefficient.

Equipment is a major problem. Engineers must be taught good design practice, including the use of specialist equipment such as ICs and logic analysers. These have never been so expensive for multi-pla laboratory stations. Simple

education boards with hexagonal layouts can only teach bad habits and should be avoided after week two. At Cardiff we have used the recent laboratory grant to purchase multiple disc-based \$100 pc computers. All students write even the simplest routines in assembler code and learn to use editors, etc. from the beginning.

Equipment for the computer science side can be cheaper since they only need programming tools. The very cheap machines like the PET are not much good for this work; discrete based machines using the CP/M operating system give access to a wide range of software. Multiple single-user micros taking advantage of the low price of personal computers are much easier to maintain than a time-shared mini, let alone a mainframe. There is definitely a move to replace shared mini-mainframe facilities with multiple microcomputers linked into an in-house network. Any user who has a free from shared mainframe facilities for micro work in a CP/M based system will not be willing to go back.

General computer users, growing in number in any one department, e.g. geology, psychology, astronomy, etc. are not in any way interested in microprocessors, only in cheap computing. Unfortunately, they do not realize that and confusion is the result. Computing has been traditionally provided by centralised mainframes, controlled by a computer centre, a service department. Individual departments can buy PCs and Apple within their own budgets and do so with no reference to any central authority.

This is quite wrong and the big claims down must come quickly. Computer centres must take on the new and expanding role of supplying shared facilities and advising on distributed microcomputers. They should maintain a pool of equipment for user users. Only in this way will users be protected from the cut-throat competition of the lack of appreciation of the cost of software, communications and maintenance. A central control can also act as a purchasing and maintenance agency, using bulk purchases to negotiate reductions in price.

It can also act as a shared software library, distributing discs in much the same way as maintaining a central library on the mainframe. Such a unit could possibly expand to support a maintenance extension to reduce staff bills. Unfortunately, many university computer centres are riddled with the "we will sink with our main frame" brush, which creates a barrier between users and encourages the inefficient growth of microcomputers. Once again

cooperation between the departments is the key.

It is very important that the computer courses establish service centres for users. The electrical engineering departments' laboratories and technicians are geared towards teaching of microprocessor engineering and simply cannot cope with general microcomputer inquiries.

To date, microprocessors have been bad for research work. Nothing is really new, except the price with the resulting range of applications. Applications are the dominant areas of work and this is more development than research. There is little in micros for software specialists. There was no interest in, say, real-time operating systems, since this was covered years ago with minis. Unfortunately, the engineers needed operating systems to develop poor ones themselves. The D before R problem is compounded by industry's lack of engineers which means more lucrative job offers and fewer than usual takers for the SIC's meagre grants.

Further, in such a climate, engineers would have been irresponsible not to have encouraged development work at the time. Now one hopes that the excellent industrial relations established during the early phases will expand into more pure research, although in what areas it is not immediately clear. One thing is clear, however, and that is that bigger research grants are needed to attract a sufficient percentage of United Kingdom graduates into further education for our own future good.

The general interest in microcomputers can only be to the long term good. The short term, however, is rather chaotic and not very good, due in the main to the unavoidable fact that the teachers themselves are learning at the same time, so fast has been the change. Inter-departmental cooperation is so desirable and yet so difficult to achieve. The haphazard purchasing of stand-alone microcomputers by any department without reference to a computer centre will cause many troubles in the form of support for software and maintenance. The computer centres must quickly establish support and advisory centres and then sell their services to the users. Over the next few years virtually all university computing will migrate from central mainframes to individual microcomputers; they will become powerful enough even for large number crunching jobs. Just as industry must adjust to distributed computing and networks, so must universities services, not just research work.

The author is professor of microprocessor engineering at University College, Cardiff.

Striding towards a cure

Computers come in three definite sizes: large main-frame number crunching machines as manufactured by ICL and IBM; mini-computers used for controlling special processes and often linked to different output peripherals. A major manufacturer is Digital Equipment Corporation; Single board computers based on microprocessors. These are mainly American in origin and manufactured by companies such as Intel, Motorola and Zilog.

One application for large main-frame computers in biomedical engineering is in modelling and simulation where the computer is used to solve the equations or logical relationships that comprise the model. By this method the operation of the model can be studied, and, from it, properties concerning the behaviour of the actual system can be inferred.

For example, the medical researcher studying pulsatile flow in distensible blood vessels may drive his system with a pump that generates the desired pressure variations, what means it is not immediately clear. One thing is clear, however, and that is that bigger research grants are needed to attract a sufficient percentage of United Kingdom graduates into further education for our own future good.

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Another application for the main-frame digital computers is in using computer packages which require large amounts of memory. For example, in a finite element technique (PAPEC 75 Program for Automatic Finite Element Calculation). In this a model of the structure is divided into small interlocking structural elements called finite elements and from these an estimate of the stress distribution in the loaded hip joint or the ventricular wall can be determined.

Minicomputers are particularly useful in on-line processing and data storage. An example of this can be seen in our laboratory at the University of Central London where a PDP 11/40 microcomputer is being used with an instrumentation system to measure the load distribution under the feet of normal subjects and patients with various conditions affecting the feet.

The measurement system consists of 124 strain gauged load cells each with a 15mm by 15mm surface area, arranged in a 16 by 8 matrix resulting in a load sensitive surface 12.5cm by 25cm (Figure 1). The output from each load cell is processed and fed to the microcomputer for storage and subsequent processing.

The load cell array is built into an 8m long walkway upon which the subjects walk barefoot at their normal speed. Their starting position is adjusted so that the foot under investigation lands on the load sensitive surface in normal gait. A piece of paper with the outline of the load cells printed on it is sandwiched between a cloth sheet and the load cells.

The cloth sheet has a waterproof upper surface and the under surface is coated with ink. When the subject steps on the load cells an inked impression of the foot is made on the paper. The upper surface of the cloth sheet is printed with the same colour as the walkway, so that the subject is unaware of the exact location of the load cells. The experiment is carried out in the room containing the microcomputer, room with a multiplexed analogue to

digital converter close to the mini-computer.

A set of Fortran and assembly language routines is built into the programmes in a multi-user environment on the microcomputer. The first programme is used to control the experiment and store on disc the raw data from a successful run; included in it are routines to check the system before each run. The second programme processes the data and outputs results in various forms. In addition, a file management routine is used to catalogue the data files stored on disc.

In the software controlled experiment, sampling is initiated by the computer looking for the output of any of the load cells to exceed a present threshold. This causes a loss of the initial part of the signal on a few channels which are initially loaded, but has the advantage of not storing useless data or using an external sensor to trigger sampling. Since it is convenient to manipulate 8-bit bytes (of the 16k words of the PDP 11/40) only 8-bit difference between successive 12-bit samples of any channel is stored, thus reducing the data size requirement by half.

Sixty-four samples are stored in each channel requiring a total of 4k words. The usual sampling rate is 85Hz, enabling data to be captured for 0.75 s (the time of the normal footfall is about 0.6 s). The sampling frequency can be changed by the operator in order to accommodate subjects who walk faster or slower than normal, but the designers of the system are not the designers of integrated circuits but also the designers capable of creating useful tools that speed the development of products.

Incorporating the microcomputer and the designers of the products suggest continued sales of increasingly complex devices with the capability of a single component reaching the capability of the majority of today's computers within 10 years.

The question then arises as to what is to be done with such cheap and complex devices. In many industries the question has been partially answered: microcomputers are being used to replace complex mechanical, electrical and electronic sub-assemblies in products from the telephone exchange to the sewing machine, they are being used to create new features for products and the skill point, the guided missile and the exhalation monitor and they are being considered for the improvement of the production process from beer and bread to plastics and roofing felt.

However, the important at present is the dominant computer suppliers and manufacturers is in the development of automated office systems which exploit the microprocessor and which are linked to communications networks. These computers clearly see a market which will lead to a switch from paper as the medium for business records and communications to media compatible with electronic systems. The reason that companies want to use computers in the office is that they can improve the productivity of the office worker and often allow the use of less highly trained staff.

The typist, for example, with a word processor has access to rosy, properly paragraphs and any mistakes can be corrected before the document is printed or transmitted electronically; there are even systems that will warn the typist of potential spelling mistakes. In many industries the productivity of the manufacturing plant has steadily increased. The price of their products has therefore increasingly reflected the cost of raw materials, of energy consumption and the cost of office work. The increases in office productivity of more than 100 per cent claimed by some suppliers of sophisticated electronic systems can therefore be an attractive way of reducing overall costs.

In higher education where the majority of costs are in salaries and where there are pressures to cut costs while maintaining or even increasing teaching loads automation of administration seems to be one of the only ways of reducing recurrent expenditure. In most higher education establishments this will largely be an evolution from existing ways of using computers for administration except perhaps at the departmental level where the availability of the cheaper computer and the easy-to-use display and keyboard based on the microprocessor brings computer use to the individual as it has already done for the individual pharmacist, solicitor, estate agent and farmer.

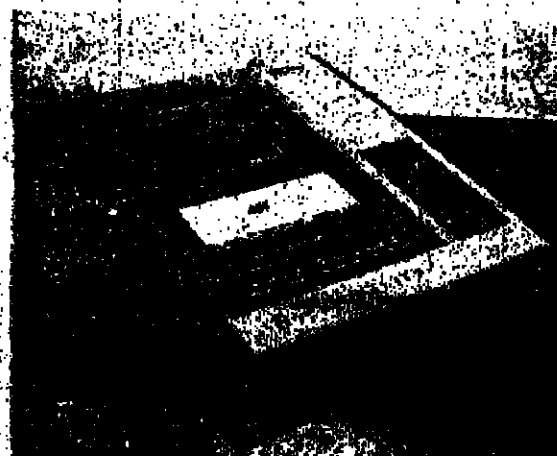
Timetables, interview schedules, room allocation, departmental and research budget accounts, assessment records for students, production of standard letters, reports in standard format, data for members of staff, lists of addresses, classified careers advice and schedules of meetings are all capable of being handled by the computer. Handling many of these tasks in at least a semi-automatic way could release secretarial and

Much of the work involved in the project went into developing a data collection programme which could reliably distinguish between back stroke and toe-off and could also be the errors which would be caused by dragging the foot during the swing-through stage of the gait cycle.

To carry out run a patient passed through the beam of a photostereographic camera which recorded the arrival on the transducing surface of the walkway. While on the walkway, the subject's gait factors, such as stride length and speed, were measured until the patient passed through the beam of a second photo-sensor. The system is being used with patients before and after hip operations in order to evaluate the different treatment regimes.

William Hutton

The author is principal lecturer at the Polytechnic of Central London.



microprocessors in education

Whether you are teaching about microprocessors and their applications or using the code for control systems, the microcomputer is the model to choose. It is a purpose designed educational microcomputer based on the 280 microprocessor and uses a video display for data input and display. The system includes a 1000-line experimental keypadboard which provides a permanent record of work done without laborious note taking and an optional TV interface allows viewing to groups.

The microcomputer for classroom use is the Sorcery which has a good graphic system and can also work as a word processor. It is based on the 280 microprocessor. The unique ROM-PAC cartridge contains the programming language in ready-to-use memory making it easy to change from one operating language to another. Please write for further details.

Cambridge Scientific Ltd, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

MICRO-COMPUTERS IN HIGHER EDUCATION

by John Mark

Developments in microelectronics have reached a stage where the majority of parts of a computer that 20 years ago would have been integrated into a square of silicon a few millimetres across. The major cost of equipment incorporating these devices has shifted from the electronics to items like cases, switches, printers, displays and keyboards. Commercial pressures on the manufacturers of the electronic parts of the computer, the manufacturers of the integrated circuits, are making them produce new devices of similar prices to the old ones but with increased capabilities.

The constraints on these developments are unlikely to be caused by technical restrictions but by the availability of capital to re-equip the factories with machines capable of producing the more intricate patterns on the silicon slices. Other restrictions are also likely to be due to a shortage of skilled designers, not only the designers of integrated circuits but also the designers capable of creating useful tools that speed the development of products. Incorporating the microcomputer and the designers of the products suggest continued sales of increasingly complex devices with the capability of a single component reaching the capability of the majority of today's computers within 10 years.

The question then arises as to what is to be done with such cheap and complex devices. In many industries the question has been partially answered: microcomputers are being used to replace complex mechanical, electrical and electronic sub-assemblies in products from the telephone exchange to the sewing machine, they are being used to create new features for products and the skill point, the guided missile and the exhalation monitor and they are being considered for the improvement of the production process from beer and bread to plastics and roofing felt.

However, the important at present is the dominant computer suppliers and manufacturers is in the development of automated office systems which exploit the microprocessor and which are linked to communications networks. These computers clearly see a market which will lead to a switch from paper as the medium for business records and communications to media compatible with electronic systems. The reason that companies want to use computers in the office is that they can improve the productivity of the office worker and often allow the use of less highly trained staff.

The typist, for example, with a word processor has access to rosy, properly paragraphs and any mistakes can be corrected before the document is printed or transmitted electronically; there are even systems that will warn the typist of potential spelling mistakes. In many industries the productivity of the manufacturing plant has steadily increased. The price of their products has therefore increasingly reflected the cost of raw materials, of energy consumption and the cost of office work. The increases in office productivity of more than 100 per cent claimed by some suppliers of sophisticated electronic systems can therefore be an attractive way of reducing overall costs.

In higher education where the majority of costs are in salaries and where there are pressures to cut costs while maintaining or even increasing teaching loads automation of administration seems to be one of the only ways of reducing recurrent expenditure. In most higher education establishments this will largely be an evolution from existing ways of using computers for administration except perhaps at the departmental level where the availability of the cheaper computer and the easy-to-use display and keyboard based on the microprocessor brings computer use to the individual as it has already done for the individual pharmacist, solicitor, estate agent and farmer.

Timetables, interview schedules, room allocation, departmental and research budget accounts, assessment records for students, production of standard letters, reports in standard format, data for members of staff, lists of addresses, classified careers advice and schedules of meetings are all capable of being handled by the computer. Handling many of these tasks in at least a semi-automatic way could release secretarial and

Much of the work involved in the project went into developing a data collection programme which could reliably distinguish between back stroke and toe-off and could also be the errors which would be caused by dragging the foot during the swing-through stage of the gait cycle.

To carry out run a patient passed through the beam of a photostereographic camera which recorded the arrival on the transducing surface of the walkway. While on the walkway, the subject's gait factors, such as stride length and speed, were measured until the patient passed through the beam of a second photo-sensor. The system is being used with patients before and after hip operations in order to evaluate the different treatment regimes.

William Hutton

The author is principal lecturer at the Polytechnic of Central London.

Silicon wizardry conjures up a staffing revolution

academic staff of some of the routine clerical tasks required to run a department and release them for other duties.

The promise of releasing teaching staff through the use of computer aided teaching has received little attention from the cheaper microcomputer except in incidental improvements to equipment like projectors and recorders. It is frustrating to know that if only we could analyse our teaching methods and then there is little doubt that computers could be built to assist in the teaching task. Only in the teaching of mechanical skills such as those required for performing arithmetic, for systematic design or in finding have computer-aided teaching systems received substantial use.

There is therefore scope for research into appropriate sequences of tuition, into methods of assessing progress, into handling questions and responses in a way adaptable to the individual. The research would need to be directed at the teaching of specific topics with a view to the precise formulations of methods required by computer-based systems. Stimulus for these developments has already come from industry faced on the one hand with a shortage of skilled labour yet on the other an excess of labour.

A solution to many of their problems is the retraining of labour. Teachers of the specialist skills with a knowledge of specific industries are in short supply and the varied motivations, backgrounds and availability of trainees often make it difficult to organise formal and scheduled classes. For those reasons industry has been willing to purchase the services of computer aided teaching machines for some of its training and in the future will continue to promote developments through industry's interest and its funds.

Simulation has been a successful aid to the teacher in any subject. Simulation using the microcomputer can be used to display calculated trajectories of particles for physicists, to demonstrate the growth of competing groups of plants and organisms, to demonstrate mechanisms, to illustrate the behaviour of electronic circuits or to display the effects of a variety of battle strategies on marketing campaigns. Simulation where the precise basis for the simulation is established, can serve as a substitute for large, expensive, time consuming or impractical experiments and can allow the student to observe the implications of theories without becoming entangled in complex experimental detail and uncertainty.

The dangers of this approach are that we simulate where direct experience is practicable and more convincing because of its reality and that the student will expect real experiences and solutions to be obtainable merely by pressing buttons in the correct sequence. Simulation is therefore a useful teaching aid and has become a practical and cheap alternative for slowing certain effects through the application of the microcomputer.

The personal computer is seen by some as a portable notebook of the future. It will be able to contain the equivalent of several textbooks, perform simulations and calculations and be able to link to centralized databases-computer based libraries. There seems little that is new in such a system apart from the medium used to hold the data and texts. The advantages of the new system would come from the electronic speeds at which the devices could work giving apparently instantaneous access to texts stored on magnetic media.

A student could with the use of rapid access to many large libraries, with administrative chores removed, with teaching machines providing interest for the learner and releasing the teacher from mundane tasks such as the technical eye, a few

the point, however, the bulk of

change that this implies, the work to be carried out to prepare texts and procedures for computer use, the building of the new equipment, the construction of buildings to house the equipment, the devising of methods of funding and investment and the creation of legislative machinery to protect privacy and commercial interests will all serve to slow down the rate at which the possibility becomes a reality.

Nevertheless the business world has seen advantages in these systems and although the media are of value to the student, the researcher and the teacher their progress, their funding and their characteristics are likely to be shaped by industry and commerce. If office work becomes largely electronically based the sources of statistics and much scientific data will become stored on electronic media which the researcher will need to learn to use.

With computers supervising each minute access of data it becomes possible to record who has fetched the data. Coupling this with the growing awareness of the costs of collecting,

Universities continued

BAYERO UNIVERSITY, KANO
NIGERIA

Applications are invited from suitably qualified candidates for the following vacancies:

- English and European
Language:
Management Studies:
Library Science:
Education:
Mass Communication:
Law:
Estate Department:
- Professor
Reader
Professor
Senior Lecturer
Lecturer I and II
Professor
Senior Lecturer
Lecturer I and II
Professor
Senior Lecturer
Lecturer I and II
Professor
Senior Lecturer
Lecturer I and II
Professor
Senior Lecturer
Lecturer I and II
Senior Structural Engineer
Senior Estate Architect

SALARIES
GL 16 N11,538-N14,260 p.a.
GL 13/14 N8,004-N10,128 p.a.
GL 12/13 N7,401-N8,052 p.a.
GL 10/11 N5,700-N7,284 p.a.
GL 10 N5,780-N6,732 p.a.
Senior Estate Architect GL 11 N6,744-N7,294 p.a.
N11 equals 80p approximately.

CONDITIONS OF SERVICE
Appointments on permanent or contract basis. Contract appointments attract an addition of 25 per cent of basic salary. Part-time accommodation. Passages for self and up to five children.

METHOD OF APPLICATION
Six typewritten copies of curriculum vitae stating post, full name, date and place of birth, current postal address, telephone number, nationality, marital status, educational qualifications with dates, posts held with dates, detailed list of publications. Names of three referees who know you professionally. Applicants should request their referees to forward confidential reports to:

Principal Assistant Secretary (Recruitment),
Nigerian Universities Office,
180 Tottenham Court Road,
London W1P 0LE.
to whom enquiries for further particulars and areas of specialisation required should be addressed.

UNIVERSITY OF CALABAR, CALABAR
FACULTY OF ARTS

Applications are invited from suitably qualified candidates for the post of Professor in the Department of History of the University of Calabar.

Area of Specialization: African History.

Qualifications: A candidate for the post MUST be a distinguished scholar with appropriate teaching and research experience as evidenced in published works. The candidate MUST also have previous experience in the supervision of higher degree students at both Masters and the Ph.D. levels.

Salary: Grade Level 16 (N11,538-N12,720). Point of entry depends on qualifications and experience. Method of Application: Interested candidates should forward six copies of their applications with detailed curriculum vitae to:

P.A.S. (Recruitment)
Nigerian Universities Office
180 Tottenham Court Road
London W1P 0LE
England.

They should also include two copies of each of their published works in support of their application. Candidates are also advised to request their referees (3) to forward confidential reports on them direct to the Nigerian Universities Office.

The Papua New Guinea University of Technology
Department of Mathematics

PROFESSOR AND HEAD OF DEPARTMENT
The Department of Mathematics is primarily a service department teaching Mathematics to students of Engineering, Surveying, Applied Science, Architecture, Accounting and Business Studies. The Department also offers a postgraduate programme in Engineering Mathematics. Current research interests are in areas of Astrophysics, Computing, General Relativity, Mathematical Modelling, Mathematics Education, Numerical Science and Theoretical Cosmology. Associated with the Department is a Research and Development Unit, the Mathematics Education Centre, which has been set up to study the problems associated with the teaching and learning of mathematics in Papua New Guinea.

Qualifications: A higher degree in Mathematics or related field with extensive teaching experience at the tertiary level and a demonstrable concern for the problems associated with the teaching of Mathematics as a service subject. Evidence of professional activity in Applied Mathematics and/or Mathematics Education. In addition a candidate should be able to demonstrate qualities of leadership consistent with the running of a Department of 19 professional mathematicians and mathematicians equivalent.

Salary: K26,710 (Kina 1 equals £1,431).

Initial contract period, three years. Other benefits include a gratuity equivalent to 25 per cent of basic salary, pensionable superannuation, and leave leave (total member and family), travelling and out of pocket allowances, air travel, car, house, education fees and assistance towards school fees. Free housing, salary continuation and medical benefits scheme available.

Detailed applications (two copies) with curriculum vitae, together with the names and addresses of three referees, should be received by the Registrar, Papua New Guinea University of Technology, Box 703, Lae, Papua New Guinea, by 15 August 1980. Applicants resident in the UK should also send a copy to Association of Commonwealth Universities (App.), 36 Gordon Square, London WC1H 0PF.

UNIVERSITY OF CAMBRIDGE
Faculty of Economics and
Politics
Young Economist/
Statistician

required from October/November, 1980, to teach statistics at undergraduate level and to assist members of the teaching staff with the preparation of statistical material.

Applicants should have a good degree in economics with either some training in statistics or appropriate statistical experience in a government office or other organization.

Salary Scales (1979-80) £4,729-£6,082

Starting point will depend upon age and experience. Further particulars from the Secretary, Faculty of Economics and Politics, Sidgwick Avenue, Cambridge CB3 9DD, to whom applications and curriculum vitae (5 copies) should be sent by 20th August.

Applicants should name two referees and ask them to reply promptly when approached.

UNIVERSITY COLLEGE DUBLIN
FACULTY OF LAW
(TWO POSTS)

Applications are invited for two full-time academic appointments in the Faculty of Law. The appointments will be made at the level of either Assistant Lecturer or College Lecturer. For the Assistant Lecturer position, the successful candidate will be given to candidates with special interests in the fields of Criminal Law and Evidence. There is a non-contributory pension scheme.

Entry point on the relevant scale will be in accordance with qualifications and experience. There is a non-contributory pension scheme. Prior to application, further information (including application procedures) should be obtained from the Secretary and Registrar, University College, Belfield, Dublin 4, Ireland. Please quote Ref. No. GNT2.

Telephone enquiries: 883244, ext. 431.
The latest date for receipt of completed applications is Thursday, 14th August, 1980.

University
college of
swansea

Chair of English
Language and
Literature

Applications are invited for the Chair of English Language and Literature, which has become vacant on the retirement of Professor C. J. L. Price.

Applicants should be graduates with qualifications in English Language and Literature, which has become vacant on the retirement of Professor C. J. L. Price.

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Universities continued

GLASGOW
THE UNIVERSITY
DEPARTMENT OF ENGLISH
LECTURERSHIP

Applications are invited for a Lectureship in English Literature, to be held in the Department of English Literature, Glasgow University.

Applicants should have a good degree in English Literature, with a special interest in the field of English Literature, and a demonstrated ability to teach at the university level.

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THE ADVERTISING MANAGER

Applications are invited for the post of Advertising Manager, to be held in the Department of Advertising, Glasgow University.

Applicants should have a good degree in Advertising, with a special interest in the field of Advertising, and a demonstrated ability to teach at the university level.

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MIDDLESEX

Applications are invited for the post of Lecturer in English Literature, to be held in the Department of English Literature, Middlesex University.

Applicants should have a good degree in English Literature, with a special interest in the field of English Literature, and a demonstrated ability to teach at the university level.

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NEW ZEALAND

Applications are invited for the post of Lecturer in English Literature, to be held in the Department of English Literature, New Zealand University.

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THE OPEN UNIVERSITY

Applications are invited for the post of Lecturer in English Literature, to be held in the Department of English Literature, The Open University.

Applicants should have a good degree in English Literature, with a special interest in the field of English Literature, and a demonstrated ability to teach at the university level.

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DYFED

Applications are invited for the post of Lecturer in English Literature, to be held in the Department of English Literature, Dyfed University.

Applicants should have a good degree in English Literature, with a special interest in the field of English Literature, and a demonstrated ability to teach at the university level.

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Overseas continued

CAULFIELD INSTITUTE OF TECHNOLOGY, MELBOURNE, AUSTRALIA
SCHOOL OF COMPUTING AND INFORMATION SYSTEMS
Department of Robotics and Digital Technology

Principal Lecturer

(Full Time)

Applications are invited for the position of Principal Lecturer in Digital Technology. The appointee will be responsible to the Dean of the School for the overall development of the new Department of Robotics and Digital Technology with respect to:

- the establishment of a Centre for Robotics;
- the establishment of a Laboratory of Digital Technology;
- the development of education in robotics;
- the formation of a research and development group to develop and design prototype robotic devices;
- the design and construction of facilities for the development and production of micro-electronic circuits and systems;
- the development of relevant education for training people in the manufacture and use of micro-electronic circuits and systems; and
- the development of a research and development group to develop and design prototype robotic devices.

A high qualification in computer science and/or digital electronics is essential together with specialisation in an area of robotics, artificial intelligence, and/or equipment in digital control of mechanical systems or a proven working knowledge of digital technology.

The appointee must be fit to undertake or form a research and development group.

Salary: \$42,784 p.a. (including superannuation). Successful applicants should obtain a job application form from the Staff Officer.

Written applications, in duplicate, quoting the reference number and including curriculum vitae, should be sent to the Staff Officer, Caulfield Institute of Technology, 900 Dandenong Road, Caulfield East, 3145, Victoria, Australia.

UNIVERSITY OF GUYANA
VACANCIES
INSTITUTE OF DEVELOPMENT STUDIES

The Institute of Development Studies at the University of Guyana, invites applications for research positions in the following subject areas:

- LAW**
(One (1) Research Fellow or Senior Research Fellow)
The Role of Law and the Administration of Justice in Guyana.
- POLITICAL SCIENCE**
(One (1) Research Fellow or Senior Research Fellow)
Foreign Intervention in the Caribbean.
- SOCIOLOGY**
(One (1) Research Fellow or Senior Research Fellow)
Change in Family Organization in Guyana and Trinidad.
- GENERAL**
(Two (2) Research Assistants)
To be assigned.

The final determination of the terms of reference and general framework of the studies chosen will be done in consultation with the Director of the Institute of Development Studies. For the Research Fellow posts, first degree is necessary and for the Research Assistant posts a postgraduate degree and/or research experience will be an advantage. The appointments are for a two-year contract.

SALARY SCALES (PER ANNUM): U.S. \$1,000-\$12,500 approx.
Research Fellow: U.S. \$5,000 x \$12,500-\$14,750.
Senior Research Fellow: U.S. \$12,500 x \$15,000-\$18,000.
Research Assistant: U.S. \$4,000 x \$4,500-\$5,500.

Benefits include a gratuity, housing allowance, contributory medical scheme and leave on satisfactory completion of contract. Any person recruited from overseas will receive up to four months' salary in lieu of travel expenses (i.e. for himself, wife, spouse and dependent children up to 10 years of age), limited travel expenses and a settling-in allowance.

Applications (three copies) stating name, date of birth, marital status, qualifications with dates obtained, work experience (with dates), names and addresses of three referees (one of the referees must be your present or last employer where applicable), must reach the Personnel Officer, University of Guyana, P.O. Box 641, Georgetown, Guyana, before 31.12.1980.

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Gray's Inn Road, London WC1A 0BZ

EDUCATIONAL
POSTS OVERSEASMinistry of Posts, Telegraphs and Telephones
(Saudi Arabia)

The British Council has been asked to provide English Language instruction for trainees at the Telecommunications and Broadcasting Training Institutes and the Saudi Telephone Training Centres at Riyadh and Jeddah. THE WORK will be based on an English for Special Purposes approach and will combine subject instruction and the teaching of English skills in job-oriented exercises. The subjects include mathematics, electronics, electricity and power engineering as well as specialized job areas of telecommunications, broadcasting and telephone operation, maintenance and repair. Students will be trained to follow technical lectures wholly or partly in English, to undertake problem-solving exercises in English and to use a wide range of English technical manuals.

The following staff will be required for September, 1980.

DIRECTOR (based in Riyadh)

Telecommunications and Broadcasting Training Institute, Riyadh

PROGRAMME MANAGER (Deputy Director)

CHIEF INSTRUCTOR

15 INSTRUCTORS

REPROGRAPHICS SPECIALIST

Telecommunications and Broadcasting Training Institute, Jeddah

CHIEF INSTRUCTOR

8 INSTRUCTORS

Saudi Telephone Training Centre, Riyadh

PROGRAMME MANAGER (Deputy Director)

CHIEF INSTRUCTOR

7 INSTRUCTORS

Saudi Telephone Training Centre, Jeddah

CHIEF INSTRUCTOR

5 INSTRUCTORS

A further 10 Instructors will be required by January, 1981. All posts are for men only.

THE DIRECTOR will have overall responsibility under the Ministry for the design and implementation of this programme. He will direct the London-recruited teaching staff and a locally engaged support and administrative staff.

Candidates must have a postgraduate qualification in EFL or Applied Linguistics, extensive relevant experience in ESP and materials preparation and course design and considerable administrative experience in positions of leadership. Some experience of the Arab world is desirable.

THE STAFF will have either a postgraduate qualification in EFL or Applied Linguistics and some TEFL experience or a relevant scientific or technical qualification with experience of or interest in the linguistic problems of foreign students of science and technology. Programme Managers and Chief Instructors will have administrative experience and leadership skills. There will be opportunities for course design, materials preparation and class-room teaching and administration. On-the-job training will be provided for those whose background is in language teaching or in technical instruction and who are interested in relating the two.

TERMS OF SERVICE

Basic Salaries:
Director: SR7,000 per Hijra month (29 days) annually reviewed.

Programme Managers: Starting at SR5,583 per Hijra month rising by annual increments of SR130 (app) to SR5,995.

Chief Instructors: Starting at SR5,093 per Hijra month rising to SR5,453.

Instructors & Reprographic Specialist: Starting salary in the range of SR1,268-SR4,934 according to age, qualifications and experience. Annual increments.

Other Emoluments:
Post Allowance: SR250 per month (single), SR700 (married).

Transport Allowance: SR500 per month.

Baggage Allowance: Half of first month's salary.

Child Allowance: SR125 per month (under five), SR200 (over five).

Education Allowance: SR10,000 per annum (first child), SR8,000 per annum (second child).

There is no taxation in Saudi Arabia and earnings are fully convertible to sterling. Current rate of exchange £1=SR7.84.

Benefits:
Free furnished accommodation; termination grant after three years' service; 45 days' paid leave per annum; sick leave; fully refundable contracts with the British Council.

KEY ENGLISH LANGUAGE TEACHING SCHEME

The following post is wholly financed by the British Government as part of Britain's programme of aid to developing countries under the Key English Language Teaching (KELT) Scheme.

LECTURER IN ESP METHODOLOGY (Syria)

University of Damascus

This is the Senior of two new posts designed to assist in establishing a Centre for teaching English for Specific Purposes within the University of Damascus.

Duties: to be responsible to the Centre Director for the design and direction of training courses conducted by the Centre; establishment and maintenance of the Centre.

Qualifications: Candidates, aged 35-50, must be UK citizens; have a degree plus one-year Postgraduate TEFL qualification or MA in Applied Linguistics; and five years' teaching experience including a minimum of two years' able, experience overseas. Knowledge of Arabic desirable.

Salary: £10,386-£12,272 (including 10% Inducement). Married Overseas Allowance: In the range of £240-£300 p.a.

Benefits: Salary free of UK Income Tax; free family passages; children's education allowances and holiday visits; free furnished accommodation; outfit allowance; medical scheme; baggage allowance; paid leave.

Post tenable September, 1980. Contract will be initial for two years. The Selection Board will be held in July/August.

Return fares are paid. Local contracts are guaranteed by the British Council. Please write to the British Council, 11, Bedford Square, London WC1A 1EJ, for further details and application form to the British Council (Appointments), 8, Davies Street, London W1V 6AA.

RESEARCH IN ENERGY
TECHNOLOGY

1. FLUIDISED BED COMBUSTION
(RESEARCH & DEVELOPMENT ASSISTANT)

2. SOLAR ENERGY
(RESEARCH ASSOCIATE AND R & D ASSISTANT)

Applications are invited from graduates of Engineering or Physical Sciences to work on Fluidised Bed Combustion or Solar Energy. Candidates should have an interest in combustion and/or renewable energy. An attractive grant/salary will be paid to a suitable candidate.

Post holders and Post Graduate Research Students are invited to apply for research posts in the following areas:

- Speciation of the atmospheric sulphur cycle.
- Modelling of the atmospheric sulphur cycle.
- Modelling of the atmospheric sulphur cycle.

Applicants should send three copies of their curriculum vitae, including details of their research interests, to the Personnel Officer, University of Petroleum & Minerals, P.O. Box 813, Dhahran, Saudi Arabia.

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University of Petroleum
& Minerals

Dhahran, Saudi Arabia

The Department of Physics will have faculty positions for the academic year 1981-82, starting 1 September 1981.

Academic Qualifications and Experience:

Physicists with PhD Degrees interested in teaching and developing laboratories for M.Sc. Program in Physics are sought.

Facilities available are: IBM 370/158, PDP 11, Mossbauer Spectrometer, Nitrogen and Helium Liquifiers, X-ray Spectrometer, GCA/McPherson ESCA-36, Varian FT-80A Infrared Spectrometer, Varian 3117 NMR Spectrometer, and a Laser Raman Spectrometer.

Language of instruction is English.

Minimum regular contract for two years, renewable.

Competitive salaries and allowances. Air transportation to and from Dhahran each year. Attractive educational assistance for school-age dependent children. All earned income exempt from Saudi taxes. Ten months' duty leave with two months' vacation with salary. There is also a possibility of selection for University's ongoing summer program with good additional compensation.

Apply with complete resume on academic, professional and personal data, list of references, publications and degrees, including home and office addresses and telephone numbers, to: Dean of Faculty of Sciences, University of Petroleum & Minerals, P.O. Box 813, Dhahran, Saudi Arabia.

Apply with complete resume on academic, professional and personal data, list of references, publications and degrees, including home and office addresses and telephone numbers, to: Dean of Faculty of Sciences, University of Petroleum & Minerals, P.O. Box 813, Dhahran, Saudi Arabia.

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Union view

Judicial stick
descends on
Burnham body

The Burnham Further Education Committee came in for some judicial stick in the High Court last week. Delivering judgment in favour of Naffie and the Central Arbitration Committee, against Gloucestershire County Council, Justice Klinger-Brown declared that the Burnham Committee had failed in its statutory duty. The case concerned an appeal by Gloucestershire against the finding of the Central Arbitration Committee that the county had agreed in 1976 to increase its lecturers' rates by 29 per cent an hour in 1976. Naffie had filed a petition under Schedule 11 of the Employment Protection Act, and the arbitration committee rejected Gloucestershire's view that part-time rates were fixed by statutory process and therefore lay outside the scope of Schedule 11. On this point the county appealed against the finding of the Central Arbitration Committee. The High Court threw out the appeal and in doing so took a side swipe at Burnham, which it said should fix the rates statutorily, as it does, but which it did not do in the year in question.

By some quirk of fate, on the same day that Justice Klinger-Brown was judicially criticizing the Burnham committee, it was enmeshed in its own statutory web of arbitration. The committee was assembled before Professor Sir John Wood, who is chairing the arbitration on the 1980 teachers' claim.

This very process of statutory arbitration whereby the findings of the arbitrators become, unless the Secretary of State objects, the law of the land, is just one of the grounds of criticism of the Burnham machinery. The teachers' and employers' associations alike have criticised Burnham and called for the repeal of the 1965 Remuneration Act, on which it is based. There is, it seems, something rotten in the state of Burnham. In industrial relations terms the failure of the committee to be able to deal with salaries and conditions of service together is, to say the least, odd. It has the initial presence of DES representatives on the employers' side causes great rancour especially since the Secretary of State's findings gives the DES a second bite at the Burnham cherry, even when an arbitral award has been made. The existence of compulsory

arbitration itself perverts the bargaining process since, quite naturally, the employers' offers usually fall short of what they have in the kitty in case more should later be paid from it by arbitration. But perhaps the most damning criticism of the present arrangements is that they give rise to a salaries document which, being a statutory one, is written with the least clarity of mind. If the complaints falling on my desk every week are anything to go by, I would estimate that at least a tenth of the profession have their salaries wrongly determined under the Burnham Report. Carefully the difficulty of interpretation of the report resembles those connected with holy writ.

No one can believe that the present salary system fulfills the educational needs of institutions or that the existing academic management structure required, say, in polytechnics. The Burnham Committee has failed in a more basic sense as is witnessed by the fact that in the past six years its work has had to be taken over by two

natfhe

commissions, Houghton and Clegg, and now an arbitral body.

Thus, the demand for the abolition of Burnham and its replacement by a non-statutory collective bargaining committee which would allow the joint determination of salaries and conditions of service to enter the much heralded NJC for Further Education teachers which at the present can only deal with conditions but which, if the 1965 Act is repealed, could do Burnham's job as well. Given the sounding of trumpets it is rather ironic that the NJC has got off to such a faltering start. Its first meeting had to be adjourned because of poor attendance by the management panel; its second was hardly more successful since it failed in reaching agreement on anything of significance in spite of there being lengthy items like redundancies in further and higher education on its agenda. One cannot be surprised that the teachers feel faced with a choice of the devil of Burnham, or the deep blue sea of the NJC.

There has been a good month for lawyers. Their livelihoods have been considerably enhanced during the past few years, not least by the statutory changes. Burnham, but also by the brain cranking task of interpreting the provisions of the Crombie Code for teacher education staff. This code provides, by way of statutory regulations, a statutory award. Burnham has been for teachers who lose their

employment because the Secretary of State has directed a reduction in students following initial teacher training courses. Simple enough, you may think. In fact, the regulations are so badly written that they make Burnham's opaqueness seem like light. Due to this and, frankly, the determination of the DES and some local authorities to exploit the lack of clarity of the regulations, has been engaged, in the past three years, in petitioning industrial tribunals on more than a hundred cases arising from the Crombie Code.

On this occasion the trend has gone Naffie's way—it has won over 90 per cent of the cases petitioned. That is hardly the point. The point is that resort to law has been encouraged—some would say forced—by the failure of the DES and local authorities to agree either a simple code of redundancy policies, or a scheme of interpretation of the complex one which does exist. The lesson for the future must be that if the cancer of redundancies is to spread to the rest of the higher education service, there must be understandable arrangements made and not ones which lead a caravan of cases to the courts.

Many will say that the real waste lies in the closure, for educational purposes, of more than 30 colleges of education. The present government's economic policies, and the positive gleam with which some local authorities are adopting them, cause an awful sense of déjà vu about the future of higher education. The civilized belief in higher education for its own sake seems to be giving way to a Gradgrind philosophy which would relate the whole of educational provision to the needs of an ailing economy and industry.

Meanwhile, in Parliament the Employment Bill steam-rollers its way towards the statute book. Under the Bill, the Secretary of State will be able to sack academics, especially temporary and part-time staff, easier to make redundancies and prevent, by way of the repeal of Schedule 11, redress against depressed pay and conditions. Will the educational community see sense and agree, as collective bargainers, arrangements to compensate for the erosion of individual rights? Or will it rush headlong to the courts to construct the meaning of the new law? Even the optimists must fear the latter. The present state of relations between the profession, their employers and the DES.

Well, as they say in Yorkshire, where incidentally there is another legal wrangle about part-time rates, there's nowt so daft as talk.

Keith Scribbins

The author is the assistant secretary (salaries) of the National Association of Teachers in Further and Higher Education.

Right here is
where charity
should begin

Keith Hampson

My last piece asked: "When is a colony not a colony?" The answer, apparently, is: "When it's a French department." Guadeloupe, Réunion, Martinique and French Guiana would you believe?—are no longer overseas; their students are "home" students. So too are those from Greenland.

Why should Britain treat so unfavourably French and Danish territories compared with our own dependencies, with the exception of Gibraltar? Why should concessions

be made to students from Martinique but not from the British Virgin Islands next door?

We might even find support growing in Hongkong for that avid Hongkong visitor, Labour MP Robert T. Fong, who wants the colony to have representatives at Westminster. The French have shown it pays. But the ultimate stupidity will arise when Portugal joins the EEC. Macau, across the estuary from Hongkong, then have "home student" status.

Two weeks ago I found myself again agreeing with a Liberal when David Alton argued that the Merseyside local authority, by raising its rates by 50 per cent—with every determination to go on raising them massively to pay for further increases in its spending—was doing a "diservice to the local economy" because it forced many firms to leave the area. The next day saw the Labour union outburst against Alan Fisher's suggestion of community service for unemployed young people. "The real answer," claimed Alan Fisher, "is to increase public spending to provide proper and permanent jobs."

But if the control of inflation is to be the central aim of policy, the means of achieving it are bound to involve a transitional increase in unemployment. The sooner inflation comes down, with pay increases matching the fall, the sooner it will set a turnaround in unemployment. In the meantime, government must address itself to mitigating some of the side-effects.

What is surprising about Fisher's tentative suggestion is not that it was made but that it has taken so long for a government to look seriously at the proposal. It is certainly not an original idea. The trouble is the alliance of treasury mandarins and trade union bosses. The former worry about the social cost, the latter instinctively de-

nounce anything that looks like cheap labour.

Youth unemployment is so debilitating to the individual and such a waste of human energy that some effort must be made to overcome the obstacles. As regards cost, we need not think in terms of youth opportunity wages of £23.50. Basic supplementary benefit should be the going rate. Okay, there will be no incentive for some young people to work, but there should be no compulsion. For a great many, however, the chance to do something constructive would be welcomed. Employers, moreover, when they do come to take on labour, will no doubt favour those who have shown some initiative.

There are thousands of jobs, useful but not a priority for local authorities, in the present climate. There are innumerable small ways of providing services for the elderly. CSV (Community Service Volunteers) has shown the way. But there is no reason why the finding and sifting of projects could not be handled by the MSO. Projects will have to be approved to allow union fears that unpaid youngsters will take over from full-time employees. But total flexibility is what is wanted, and a minimum of bureaucratic control. It would, I think, be worth diverting some of YOP's £150 million to launch this broader concept.

What we should really aim for is the type of programme proposed by Tory MP Alan Haselhurst in his 1978 pamphlet, *A Time For Youth*. As an alternative to hanging around in school, the envisaged variety of integrated schemes involving training, education and work experience designed to help young people prepare for and find work.

But the refinements can come later. It is other places of higher education in the country that we need to look at now.

Don's diary

Wednesday

8.00: I open my eyes—well, one eye—and peer at the radio. Push buttons, spin stainless steel knobs and arrive at this week's madrigal. Rouse children, with their first call: "You have 45 minutes. Forty-five minutes." I begin to shave, balance the small round mirror on the windowsill. The electric motor draws this week's madrigal just as it gets to "nuts! hoh!", so I stop shaving, turn up the volume and begin again. Down to the kitchen, make and sip a cup of coffee, return to the children. "Schooltime minus 30—you have half an hour!"

8.55: S minus 10. I dispense fruit juice with one hand and take in my own coffee with the other. Breakfast is nibbled, school library books found (they first had to be lost), walk to school with children, on my own way to the Aldwoods, past the house on which I put a pound of Thomas's pack lunch from the corner shop. "No, I won't buy you that chocolate—your teeth will drop out and you'll get stomach cancer."

9.25: Collect mail from porter's lodge. No cheques, no airline tickets for this morning. Ho! Ho! Unlock my room, one hand on letters, other on key, knee to the handle. Sesame!

Post: Paperback brochures: *Naked in the rat pit*. Do they think I have a waiting room? *Bureaucracy*: *Defence Test*. How many of our second-year students will purchase/borrow/photocopy/mutilate a copy? Am I a market researcher? Read through what I and my other non-professional colleagues have agreed to publish in tomorrow's *Journal of Inspection*. Actually, it's not called a tour of inspection, it's called a "visitation". Rather like potterists, or close encounters. Of the tertiary kind.

10.00: M.Sc. seminar. Shall I try a joke? It's Derby Day, and the story of a young man who helps his parents to the green across the river by the sweat of his brow. The Pilgrimage of Grace? And surely, though it's there in her text book, it wasn't about that...

10.15: A M.Sc. dissertation prospect to be discussed at the seminar. What to read on workers' control since 1945? Two undergraduate students seeking marked essays. They are in luck. I have them, at last.

12.00: A meeting with a visiting East European scholar. We talk, I of my work, he of his. I am writing a book, and accusing him of being a plagiarist. For a great many, however, the chance to do something constructive would be welcomed. Employers, moreover, when they do come to take on labour, will no doubt favour those who have shown some initiative.

There are two possible reasons for this question. One is that I'm being addressed by an American. The other arises from the advantage of having a name beginning with an early letter of the alphabet. It helps you get on. But it helps all the others, too, and in consequence the social sciences are heavy with Barkers. My caller has the wrong one. So I reply that no, I am not Professor Barker, but that I am working on it. Write letters, by hand, and photocopy them for the file. Provided the letters are not more than a couple of pages this combines the ancient elegance of the pen with the technological ease of the photocopy. And when it's done, it's done, and no waiting for the shorthand to turn to type.

13.15: Lunch with the department. The present convenor (a strange name for the incumbent of the educating chairmanship, in an institution whose professors look less like shop stewards than do those of almost any other place of higher education in the country) has realized that one of his most essen-

tial functions is to be something between master of college and holiday camp red cat, and dispense wine to his colleagues once a week at lunch. The increase in departmental civility is marked.

14.00: A meeting of the post-experience education sub-committee of the academic affairs sub-committee. When we are post-experience, are we not dead? Not quite, it seems, even on a sub-committee. A short agenda, so a long meeting.

15.00: Briefly to another committee, this being committee afternoon, where, by rare opportunity, the chance comes to stop some silliness. I whisper to an historian friend that all the goodies on the agenda are dealt with, and that I want in go and see the Derby on the student radio. Television? No, I put a pound of Thomas's pack lunch from the corner shop. "No, I won't buy you that chocolate—your teeth will drop out and you'll get stomach cancer."

16.00: Back in my room, a concerned call from the historian. How did my horse do? "It won." But that's what she's afraid of, knowing this was a first-ever bet, and seeing good luck as a prize on a path leading to moths and a bunch in the public gardens. I walk home with a thesis to read, but this may be postponed till later because in the park Thomas, teeth and stomach preserved by me this morning, waits with a football. Illusions of youth—do I hear the Wenbley crowds roar?

Through the front door and up to my study, where Hannah waits for help with revision for tomorrow's test. But can I help? When was the Pilgrimage of Grace? And surely, though it's there in her text book, it wasn't about that...

17.30: Find a quiet corner with the thesis, which takes me through supper and up to nine o'clock, with a break to help put on a rescue mission with coffee strainers and fungicides on one of Polly's goldfish. Dare I watch the movie? Not tonight. The list of unread books grows on my in-shelf, flaunting and accusing with their shiny spines. I open one. Damn! How can you review, in 600 words, a collection of 15 essays? God, not all editors. Fortunately there are diverting demands for bed-time stories.

22.00: The last cup of coffee, and a desperate decision to be brief with the collection of essays, and add it to the tail end of a review on a more accessible volume. Two books which share the words "capitalism" and "struggle" in their key word in context titles must have something in common.

23.30: Enough! They can both wait until tomorrow. Play my 67 Mozart tapes. Anyone who can survive the exertions of Bernard Levin must be the bee's knees. Letters: This morning's paper. Slowing down.

24.00: Dozing. Diminishing returns. Go to bed, and dream of the chairperson of the academic affairs sub-committee winning the Derby at 400-to-1 odds.

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